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TRANSACTIONS
Kansas Academy of Science.

VOL. VIII.

1881-82.

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TRANSACTIONS

OF THE

FOURTEENTH AND FIFTEENTH ANNUAL MEETINGS

OF THE

KANSAS ACADEMY OF SCIENCE.

(1881-82.)

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WITH THE

REPORT OF THE SECRETARY.

VOL. VIII.

TOPEKA, KANSAS:
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1883.

REPORT OF THE SECRETARY

THE FOURTEENTH ANNUAL MEETING.

The fourteenth annual meeting of the Kansas Academy of Science was held in Topeka, opening on the afternoon of Wednesday, November 9th, 1881, and occupying the remainder of that day and the two days following.

Lectures were delivered upon the evenings of the 9th and 10th in Representative Hall. The lecture of the evening of the 9th was upon the subject, "Botany Popularly Considered," by Mr. E. N. Plank, of Independence; while that of the evening of the 10th was delivered by Professor George E. Patrick, of the State University, upon "Chemistry in the Arts."

During the sessions of November 10th and 11th, the following papers were presented and discussed: "Genesis and Geology," Rev. J. H. Carruth. "The Agate Beds of Trego County, Kansas," Joseph Savage. "Preparatory Stages of a Leaf-eating Lady-bird (*Epilachna corrupta*)," E. A. Popenoe. "Ancient Stone Remains on the Continental Divide in Colorado," J. R. Mead. "Some New Medicinal Herbs indigenous to Kansas," Dr. W. S. Newlon. "The Leavenworth Coal Mines," Joseph Savage. "The Analysis of Drinking Waters," Professor G. H. Failyer. "Notes on the Habits of Certain *Momotidæ*," G. F. Gaumer. "Visualized Numerals," Dr. A. H. Thompson. "The Impurities of Water as Affecting its Value for Domestic and Manufacturing Purposes, and a Mode of Purifying It," William Tweeddale. "Salt Wells of Wichita," J. R. Mead. "Igneous Rocks of Kansas," Robert Hay. "Preliminary List of Kansas Invertebrate Fossils," George S. Chase. "The Constitution of the Sun," Prof. H. S. S. Smith. "The Fossils of Riley County," Silas C. Mason. "Notes on a Trip to Mammoth Cave," Prof. J. T. Lovewell. "Archæological Explorations in the Pécos Valley," Prof. F. H. Snow. "The Physical Basis of Ghosts," Wm. M. Crichton. "Plants of Montgomery County, Kansas," E. N. Plank. "Importance of the Spelling Reform," Prof. G. M. Stearns.

The following board of officers were elected for a term of one year: President, Prof. J. T. Lovewell, Topeka; Vice Presidents, Joseph Savage and Rev. J. H. Carruth, of Lawrence; Secretary, E. A. Popenoe, Manhattan; Treasurer, R. J. Brown, Leavenworth.

A committee consisting of Joseph Savage, I. T. Goodnow and J. T. Lovewell, appointed for the purpose of securing funds for the erection of a suitable monument to the memory of Prof. B. F. Mudge, presented a preliminary report.

A resolution was presented, and adopted, as follows:

"*Resolved*, That the Kansas Academy of Science have heard with profound sorrow of the sudden death of Linnaeus A. Thomas, a member of this Academy, well known and honored throughout the State as an earnest student of science, and a successful teacher of youth. We can only bow in humility at this visitation of Divine Providence, by which our beloved fellow-worker has been cut down in the midst of his usefulness, and we extend our sympathy to his stricken family."

THE FIFTEENTH ANNUAL MEETING.

The fifteenth annual meeting was opened at Topeka, in the Senate Chamber, on the afternoon and evening of the 16th of November, 1882, and continued over the 17th and 18th.

In pursuance of a departure from precedent adopted at the fourteenth meeting of the Academy, one of the evenings was devoted to a social reunion. The second evening was occupied by Prof. H. S. S. Smith, of the State University, in a popular lecture upon "Comets, with especial reference to Comet 'B,' of 1882."

During the remainder of the session, in addition to the transaction of business hereinafter noted, the Academy listened to the presentation and discussion of the papers in the following programme: "The Coal Fields of Cherokee County, Kansas," E. Haworth. "Notes on the Golden Turkey," Prof. Geo. F. Gaumer. "Differences of Temperature due to Local Causes," Prof. J. T. Lovewell. "Fossil Wood," Robert Hay. "Two Rare Minerals," Prof. G. E. Patrick. "Report on the Work in Kansas Botany for 1882," Rev. J. H. Carruth. "Kansas Ethnography—I. Preliminary Notice," Dr. A. H. Thompson. "Additions to the List of Kansas Coleoptera," Prof. F. H. Snow. "Are there Igneous Rocks in Cherokee County, Kansas?" E. Haworth. "Notes on the *Heloderma suspectum* (Cope)," Prof. F. H. Snow. "List of Coleoptera taken in Gallinas Cañon, N. M., in 1882," Prof. F. H. Snow. "List of Lepidoptera taken in Gallinas Cañon, N. M., in 1882," Prof. F. H. Snow. "The Pictured Rocks of Pipe Creek," Silas C. Mason. "On some American Species of *Cyclops*," Prof. F. W. Cragin. "Observations on Comet 'B,' 1882," Prof. H. S. S. Smith. "Observations on the Nesting Habits of the Guillemots at Bird Rock," Col. N. S. Goss. "Protozoan Remains in Kansas Chalk," Prof. G. E. Patrick. "Las Vegas Mineral Waters," Prof. J. T. Lovewell. "Standard Time," Prof. H. S. S. Smith. "A Plea for our Little Birds," Col. N. S. Goss. "Pleistocene Foot-Prints," Col. Henry Inman. "Cremation," Dr. W. S. Newlon.

The following proceedings of the Academy are deemed of general interest: It was voted that each year hereafter it shall be the duty of the chairman of each commission to present a brief report upon the progress of his department of science during the year; and that the President shall deliver a public address on the evening of one of the days of the meeting at the expiration of his term of office.

The committee upon the Mudge monument, Messrs. Savage, Goodnow and Lovewell, presented, through Mr. Savage, their final report of receipts and disbursements, of which the following is a statement:

RECEIPTS BY SUBSCRIPTIONS, MONUMENT FUND.

Manhattan	$212 75
Emporia	42 50
Junction City	25 00
State University	100 00
Mudge family	100 00
Academy of Science	50 00
Various, per Jos. Savage	128 93
Total monument fund	$659 18
Cost of monument	650 00
Balance in hands of the treasurer of the Academy, as permanent improvement fund	$9 18

RECEIVED FOR IMPROVEMENT OF CEMETERY LOT.

Abilene	$25 00
Salina	25 00
Total	$50 00
Disbursed on improvements	40 00
Balance in hands of local committee for immediate use in further improvement	$10 00

The election of officers for the year 1882–3, resulted as follows:

President: Dr. A. H. Thompson, Topeka.

Vice Presidents: J. R. Mead, Wichita; and Prof. G. E. Patrick, Lawrence.

Secretary: E. A. Popenoe, Manhattan.

Treasurer: R. J. Brown, Leavenworth.

The different commissions were then filled by the appointments given below.

Geology: O. H. St. John, Joseph Savage, and Robert Hay.

Mineralogy: Geo. S. Chase, G. E. Patrick, G. H. Failyer, J. C. Cooper, and Erasmus Haworth.

Chemistry: G. H. Failyer, G. E. Patrick, R. J. Brown, J. T. Lovewell, and H. E. Sadler.

Physics: J. T. Lovewell, H. S. S. Smith, and I. D. Graham.

Meteorology: F. H. Snow, J. T. Lovewell, G. H. Failyer, H. R. Hilton, and J. D. Parker.

Astronomy and Mathematics: H. S. S. Smith, J. T. Lovewell, E. Miller, and J. Lee Knight.

Botany: J. H. Carruth, E. N. Plank, and B. B. Smyth.

Zoölogy:

Entomology: E. A. Popenoe, F. H. Snow, and L. L. Dyche.

Ornithology: N. S. Goss, F. H. Snow, and C. P. Blachly.

Ichthyology: D. B. Long, F. H. Snow, and I. D. Graham.

Herpetology: F. W. Cragin and F. H. Snow.

Anthropology: A. H. Thompson, F. G. Adams, E. P. West, J. D. Parker, W. J. Griffing, and H. Inman.

Philology: D. H. Robinson, Geo. M. Stearns, and Geo. T. Fairchild.

Board of Curators: E. A. Popenoe, O. H. St. John, J. T. Lovewell, and F. H. Snow.

Publication Committee: J. T. Lovewell, Wm. Sims, and E. A. Popenoe.

PAPERS OF 1881-82.

THE COAL FIELDS OF CHEROKEE COUNTY.

BY ERASMUS HAWORTH, B. S., EMPIRE CITY, KANSAS.

The coal mines of Cherokee county are developed to such an extent that they are exceedingly interesting, both from an industrial and a scientific standpoint. The distinct veins of coal that have been found are very numerous, but the number of those which are valuable as a source of fuel is not so great. The boundary line between the Carboniferous and the Sub-carboniferous has been quite poorly defined.

On the accompanying map, the blue line marks this division line with a tolerable degree of accuracy. The small red spots farther west indicate locations where the Sub-carboniferous has been reached by digging. The south one marked in section 7, township 34, south, range 25, east, is on a hill some fifty feet higher than the surrounding plain. Near the south side of the hill, a well was sunk over sixty feet deep without striking the Sub-carboniferous, while on the northern slope, some two hundred yards away, it was reached within twenty feet. The other mark in this section shows where a well reached it in twenty feet.

In the north-central portion of section 12, township 34, south, range 24, east, is an outcropping of Sub-carboniferous rocks. The surface here is but little if any lower than at any point between here and Spring river; yet at one and a half miles east, at a depth of fifteen feet, a four-inch vein of coal was found. These facts indicate that at some time there has been a slight disturbance of the formation, either before or after the deposition of the Carboniferous, or that the Sub-carboniferous was left uneven by erosion.

I am inclined to think that the only way this Sub-carboniferous can ever be successfully studied, is to consider it in its relations to the Ozark and Boston mountains. It is generally admitted that there is a mountainous ridge of archæan rocks extending in a southwesterly direction from the vicinity of Iron Mountain, in Missouri, to the western line of Arkansas, passing through Pulaski, Salina and Hot Springs counties of that State. This archæan ridge is entirely concealed from view along the greater portion of its length, but the occasional outcroppings of archæan rocks, and the regular occurrence of succeeding formations, place its existence beyond much doubt. Using this as a starting point, it would seem reasonable that the principal oscillations of this mountain range would affect the Sub-carboniferous and even subsequent formations.

This idea may be carried still further. With but few local exceptions, the strata of our whole State dip to the northwest. We suppose these strata were mostly formed beneath the sea, and assumed approximately a horizontal position. If we now consider any one stratum, we find that, no matter how many times it has been emerged and submerged, its final position is one in which its eastern portion has been raised more than its western. In other words, if we represent the upward movements of a stratum by the positive sign +, and the downward movements by the negative sign —, we find that the algebraic sum of the oscillations of its eastern portion is greater than that of its western. We are thus led to look for the origin of these movements in the direction of their greatest effect—that is, towards the Ozark mountains.

When we consider the great number of alternate emergings and submergings of our State in connection with its almost uniformly unbroken strata, and the probable total absence of all eruptive rocks, this question becomes one of extreme importance to the structural geologist.

As we proceed westward from the boundary line between the two formations, we come at once into the coal region. Near the west line of section 8, township 34, south, range 25, east, a four-inch vein was found within fifteen feet of the surface. In section 13, township 34, south, range 24, east, a six-inch vein has been worked where it outcrops in a ravine. From this point westward and northward there are quite a number of places where surface veins have been worked. Still farther to the northwest is a large, almost circular, mound, which is at least 150 feet higher than the surrounding valley. It is principally located in sections 34 and 35 of township 33, south, range 24, east. It is locally called "Bald Mound." Its summit is covered with sandstone, beneath which is a ten to twelve-inch vein of coal. This vein is not more than fifteen feet below the highest point on the mound, so that its elevation is at least 130 feet above the surrounding plain. On the north side of the mound, at an altitude of fifty-five feet from the northern base, a shaft has been sunk 106 feet. It passed through three veins of coal. The first is a ten-inch vein, about nine feet below the surface; the second, a twelve-inch vein, eighteen feet deep; and the third, a five-inch vein, eighty feet below the surface. This shaft proved that the great body of the mound is a compact, black shale. The last four feet penetrated the Sub-carboniferous. As soon as the shale was reached a true "fault" was revealed. It trends southeast and northwest, and the walls on either side are inclined to the southwest, about 12° from vertical. This prevents the shaft from following the up-and-down line of the fault very far, but the first vein of coal shows it perfectly. The southwest side has been dropped fully three feet.

To the north and east of this mound is an almost unbroken hill of about an equal height with the mound. This long, circular hill is covered with sandstone underlaid with coal, which probably corresponds to that exposed on the summit of Bald Mound. The circular valley lying between the hill and mound was doubtless at one time covered by this same sandstone, coal

and shale. It is one of the grandest illustrations of erosion we have in the county. At a number of different places on this hill coal is being mined.

In sections 30 and 19, township 33, south, range 25, east, there is the greatest indication of disturbance I have noticed. In section 30, a ravine separates two places where coal has been mined. On the south side of the ravine the formations dip to the north, at an angle of from ten to twelve degrees. Immediately north of the ravine they dip to the south, at an angle of fully thirty degrees. The dip is greater than the incline of the hill; so much so that a few rods back from the ravine the coal outcrops on the hillside, while in the ravine it is fully six feet below the surface. Still farther north in section 19, where the hill is considerably higher, the coal is again found with a dip of about ten degrees to the south. Half a mile to the northwest are two more openings. At one of these the inclination is very plainly shown to be about ten degrees to the south. The other one is worked in an east-and-west direction, so that the dip cannot well be determined.

North of the hill is the long and almost level valley of Shawnee creek. In this valley there are at least two veins of coal, and probably three. At a good many places an eight-inch vein is worked by stripping. A deeper vein has been reached by almost every well in the valley. This vein is from twenty to thirty feet below the surface.

In section 11, township 33, south, range 24, east, a shaft has been sunk sixty feet deep. The first coal found was a twelve-inch vein at thirty feet. This seems to show an absence of the surface vein. At forty-five feet another twelve-inch vein was found, and the workmen believe that at the bottom of the shaft there is a "horse-back," which indicates a three-foot vein. From what is known of these "horse-backs," this last supposition is by no means established.

On the west side of Brush creek are numerous surface veins. Not having carefully examined them, a detailed description of them cannot be given, but they probably closely resemble those already mentioned.

The hills on the north side of Shawnee creek valley are less abrupt than those on the south. I do not know that coal has ever been found in them, but it would be no surprise to find thin veins corresponding to those farther south. On the east side of Spring river, near Smithfield, is another place where a surface vein is worked.

The next vein noted in the order of deposition is the Weir City and Stilson vein. This is the vein from which comes all the coal known in the market as "Cherokee" coal. It is extensively worked at Weir City and in the vicinity of Stilson. These two places in actual distance are but three and three-fourth miles apart, although by the roads, which follow the section lines, they are nearly six. Near each of these places the vein is shallow enough to be worked by stripping. On the accompanying map the light violet represents such places. The black squares represent shafts in which coal is mined by tunneling. At Weir City there are three such shafts. There

is no town or city at Stilson. Each coal company has built houses to rent to its miners, so that from a distance there is quite an appearance of four different villages. A careful study of this vein shows two important facts: First, That although varying in different places, its general dip is to the northwest, and is but a few feet to the mile. Second, That since the coal has been formed and compressed to its present solidity, there has been sufficient disturbance to form a great many breaks or fissures in the coal itself.

1. At the shaft north of Stilson, in section 5, a drift has been carried 225 yards to the north. In this distance the vein dipped thirteen feet. But this is very unusual. At almost all other shafts the floor is so nearly level that in a drift of 200 yards there is not enough rise or fall to be detected without careful measurements. The depth of the coal is from 28 to 40 feet. The various places marked where the mines have been worked by stripping are all on low ground, in ravines, or near to them. Just how far southeast this vein extends is not known, but it does not extend to Columbus, as is shown by a drilled well, which has been sunk 150 feet without striking it. This 150 feet consists of sandstone, shale and fire clay, and it is rumored that two or three thin veins of coal have also been passed through, although this is denied by the parties in charge of the enterprise.

Northeast of these mines the same vein is worked at Opolis and Pittsburg. These localities were not visited by the writer, but it is understood that the depths of the shafts there are in general the same as the depths of the Cherokee county shafts. In any of these places a variation of surface level would cause a corresponding variation of the depth of the coal.

With these data as guides, an attempt has been made to locate the southeastern limit of this very important vein of coal. The deep-violet line on the accompanying map is intended to represent this limit. It is interesting to note that this line is almost parallel with the line marking the boundary between the Coal-measures and the Sub-carboniferous with the line connecting the principal lead and zinc mining towns, from which it is distant about fifteen miles, and finally with the general trend of the Ozark mountains themselves.

A few miles northwest of Stilson, a 12 to 14-inch surface vein is worked. It is not known whether this is a continuous vein, or whether it is only local. This question is of no small importance; because only a few miles northwest, and therefore only a few feet higher geologically, there is an extensive limestone formation. This is the first limestone after the Sub-carboniferous, and between those two lie all of the above-mentioned coal veins. One and a half miles east of Sherman City, a boring of 200 feet found no coal. Fifteen miles east of Thayer, a vein, supposed to be the Weir City vein, was reached at 400 feet. For these statements I am indebted to Mr. R. E. Jenness, of Stilson.

Thayer has an elevation of 1,054 feet above sea level, and the point 15 miles east is about the same height. Stilson is 914 feet above sea level.

This gives 230 feet for the difference in elevation of the coal, if we reckon from the Weir City vein, and fully 300 feet, if we reckon from the surface vein referred to. The distance between the two points is 25 miles. This gives a dip of 9 feet to the mile for the Weir City vein, and of 12 feet to the mile should the coal found prove to be the surface vein above mentioned. But there can be no figures obtained which can be looked upon as being even approximately correct, until we can obtain an accurate topographical survey of the southeastern portion of the State.

2. My investigations have led me to believe that "faults" should be looked for in this part of the State. In all of these mines are a great many "horse-backs," or almost vertical seams of fire clay passing through the coal. A number of these were carefully examined, and without exception they were found to be true breaks in the coal, the irregularities of one side corresponding almost exactly with those of the other. In some instances the openings or fissures were seen to penetrate the shale above for as much as eight feet, and had the clay which filled them been removed, they would doubtless have been seen to extend much farther.

That these were made after the coal was perfectly solidified, is shown by the angles on the roughly-broken edges of the coal itself. In some cases, fragments of coal are imbedded in the fire-clay filling, and these also look to be fragments broken from perfectly solidified coal. It is difficult to ascertain the width of the fissures, because the tunnels seldom strike them at right-angles. Some are not more than twenty inches thick, while others are eight or ten feet. Their directions vary; even the same fissure does not follow the same course, but in general they trend northeast and southwest. Is it possible that they could have been formed by the northwestern portion of the strata being lowered or raised, while the southeastern remained stationary?

The sandstone and shales are very poor in fossils. I was fortunate enough to secure a very perfect specimen of the ammonite family. This was found in the shale immediately over the Weir City vein. It is of great interest, because, being a marine fossil, it shows that just after the deposition of the coal the surface was for a time covered by salt water. That this time was very short, is proved by the absence of a limestone formation.

A PRELIMINARY LIST OF FOSSILS FOUND IN RILEY COUNTY.

BY S. C. MASON, DELPHOS, KANSAS.

The rocks of Riley county belong to the Permo-Carboniferous series, and many of them furnish an abundance and variety of fossils not exceeded anywhere in the State. Many specimens have been found, the names of which have not yet been determined. These will be referred to in their proper places, in connection with the species which are clearly defined.

Prof. St. John has kindly named for me several specimens which I could not find described in any works to which I had access.

SUB-KINGDOM PROTOZOA.

(Foraminifera.)

1. *Fusilina cylindrica*, abundant.
2. *F. robusta*, abundant.

SUB-KINGDOM RADIATA.

(Polypi.)

3. *Rhombopora lepidodendroides*, common.
4. A smaller species, similar, not named, very rare.
5. *Fistulipora nodulifera*, abundant.
6. *Lophophyllum proliferum*, occasional.

ECHINODERMATA.

7. *Erisocrinus typus*, occasional basal plates.
8. *Zeacrinus mucrospinus*, occasional radial spines; also a great variety of plates and stems of species not determined.
9. *Archaeoseidaris triserrata*, spines.
10. Plates and spines of two species not determined:

SUB-KINGDOM MOLLUSKA.

(Polyzoa.)

11. *Fenestella shumardi*, occasional.
12. *Synocladia biserialis*, occasional.
13. *Polypora sp.* undetermined, rare.

BRACHIAPODA.

14. *Lingula sp.* undetermined, occasional.
15. *Productus costatus*, occasional.
16. *P. semireticulatus*, common.
17. *P. symmetricus*, common.
18. *P. longispinus*, common.
19. *P. prattenianus*, common.
20. *P. Nebrascensis*, occasional.
21. *Chonetes verneniliana*, occasional.

22. *C. glabra*, common.
23. *C. granulifera*, common.
24. *Orthis carbonaria*, occasional.
25. *Hemipronietes crassus*, common.
26. *Meekella striato costata*, occasional.
27. *Osbiculoidea sp.* undetermined, rare.
28. *Syntrilasma hemiplicata*, very rare.
29. *Rhynchonella Osagensis*, occasional.
30. *Athyrus subtilita*, common.
31. *Retzia punctulifera*, common.
32. *Spirifera cameratus*, common.
33. *S. martmia planoconvexus*, common.
34. *Speriferina Kentuckensis*, very rare.
35. *Terebratula bovidens*, very rare.
36. *Discina*, rare.

LAMELLIBRANCHIATA.

37. *Aviculopeeten occidentalis*, common.
38. *Pinna peracuta*, occasional.
39. *Myalina subquadrata*, rare.
40. *Myalina prattennala*, occasional.
41. *Schizodus Wheeleri*, occasional.
42. *Schizodus sp.*, occasional.
43. *Pleurophorus occidentalis*, common.
44. *Edmondia sp.*, occasional.
45. *Allorisma sutcuneatus*, occasional.

GASTERAPODA.

46. *Bellerophon carbonarius*, rare.
47. *Eeromphalus rugosus*, rare.
48. *Aclis sp.*, rare.
49. *Pleurotomaria sp.*, rare.

CEPHALOPODA.

50. *Nautilus sp.*, very rare.
51. *Nautilus sp.*, very rare.

SUB-KINGDOM ARTICULATA.

(Crustacea.)

52. *Phillipsia major*, very rare.
53. *Phillipsia sp.*, very rare.

FOSSIL FISH.

54. *Cladodus mortifer*, single tooth.
55. *Aggassizodus corrugatus*, single tooth.
56. *Petalodus Alleghaniansis*, single tooth.

To these we may add remains of Elephants and Mastodon, which have been found in the Loess near Manhattan, and on sand bars.

THE IGNEOUS ROCKS OF KANSAS.

(Prepared for the Academy in 1880, but not read until the meeting of 1881.)

BY ROBERT HAY, JUNCTION CITY, KANSAS.

In the title adopted for this paper, the term "igneous rocks" is used to include all rocks which owe their present structural condition in any way to the agency of a high degree of heat; but we shall carefully distinguish what are usually called metamorphic from those which, like trap, appear to have been completely fused.

Throughout a region including a dozen of the northeastern counties of the State, there are places where huge boulders break through the even surface of the prairie, or are gathered into heaps of coarse gravel. These boulders, isolated or in heaps, are mostly metamorphic sandstone (quartzite), entirely unlike the bed-rock of the district in which they are found. Some of them still show their stratified structure distinctly by layers, and others are shown to be sedimentary by containing pebbles. I have not seen or heard of any that contain fossils. These rocks were undoubtedly brought here by the agency of the ice of the post-tertiary period. It would seem that they were brought from the archæan areas of Minnesota and British America. A few miles east of Manhattan, a piece of native copper (in possession of Mrs. Dr. Best, *nee* Little), was picked up which probably came from Lake Superior. At certain places in Washington, Jackson and Douglas counties, and probably other places also, there are large mounds of gravel containing the prairie hard-heads, and *other rocks foreign to Kansas*, undoubtedly brought by the same glacial agency. The writer has no doubt that these mounds are *terminal moraines* of the glacial age, and at another time may offer for consideration the facts which led to this conclusion.

The fact now of importance is, that besides the metamorphic quartzites, others of the foreign rocks are of *true igneous origin*. We have specimens of beautiful gray and red granite, of a dark hornblende rock, and a fine piece of greenstone, all taken from a deposit on the bank of Elk creek, half a mile north of Holton. In geologic phrase, these rocks are not *in situ;* or in other words, they were transported to Kansas from their native region.

As, however, they settled before Regis Loisel, and were here some scores of millenniums before Coronado's explorations, they may be fairly styled Kansas igneous rocks, and claim some notice in any disquisition on this subject. Still, in view of the age of the rocks on which the boulders are deposited, they are only new-comers—not old settlers. When they came, the Kaw river had been running for long ages, carrying down cretacean sand and mud to form our Gulf States. These stones are Kansans, precisely as we are. They are emigrants come from afar.

In that very able outline of Kansas geology, by our esteemed friend, Professor Mudge, contained in the First Biennial Agricultural Report (1877-78 we have the statement that, "There is no slate or soapstone in Kansas. They both belong to metamorphic rocks, of which we have not a single bed." (Page 70, note.) Also, that, "There is nowhere to be seen any violent disturbance of the strata, marks of internal fire, or even any slight metamorphic action in any of our deposits."

This was made in full knowledge of the transported rocks, and also of some amount of metamorphic action manifested in the lead district of the Sub-carboniferous region in the southeast corner of the State. Of that metamorphosis, however, it may be well to speak a little more fully. The solid limestone strata of Spring river and Short Creek show little or no trace of seismic agency or metamorphic action, at least as at present known. I have neither seen nor heard of trap dike or basaltic rock. The hills on which Empire City and Galena stand are, however, immense masses of brecciated material, evidently unremoved since they were brecciated. The great bulk of the material is chert or limestone of the neighboring strata, in parts somewhat silicified, and more or less altered in structure, yet with abundance of fossils scarcely changed at all. The limestone is all in angular fragments — we have looked in vain for a water-worn piece — cemented together by amber-colored zinc blende, lead ore, and iron pyrites. It appears evident that the metallic elements were in solution when forced among the debris of the limestone rocks, and into some of the interstices the mineral matter trickled so slowly as to form true crystals, and the apertures of supply becoming closed before the crevice was filled, we have the forms of the mineral crystals beautifully shown. The peculiar wedge-shaped crystals of pyrites are worthy of attention as being very suggestive.

The questions, "Whence came the mineral solutions?" "What was the degree of temperature?" and "Whence came the heat?" for the present must remain unanswered, but we venture to suggest the following as indicating the line of investigation to be carried on that should tend to answer them:

1. Was there a great downthrow of formations west of Spring river at the close of the Sub-carboniferous age? and,

2. Was the heat evolved by the friction of the fault sufficient for the fusion of metals, and solution of iron, zinc and silicon?

3. Is there in the district of Eureka Springs, or near the white marble quarries in the Indian Territory, any outburst of granite or trappeian rock whose igneous energy reached to the Galena and Joplin districts?

The only point that we make here with any degree of assurance is, that the brecciated material is, at Short Creek, on the spot where it was metamorphosed, and that, therefore, it is in a sense true that we have in Cherokee county metamorphic rock *in situ*.

About three years ago the papers of the State were agitated by reports of a silver region in Woodson county. It was said that assays made in the

East and in Colorado of ores sent from this region, showed a yield of a considerable amount of silver to the ton; but samples sent to Prof. Patrick, at Lawrence, and to Prof. Kedzie, at Manhattan, gave no such assays, and the excitement began to die out, though one or two local enthusiasts are still toiling on. Prof. Kedzie, in a report of an assay published in the *Industrialist* (Manhattan), handled the matter rather neatly, saying that he would examine, free of charge, all silver ores sent to him from that region, and expected still to have some leisure for other pursuits.

About a year and a half ago, Mr. Savage and Prof. Patrick called the writer's attention to certain specimens which had been sent to Lawrence for examination from Woodson county, and which were different from any known stratified rock in Kansas. The suggestion was that they were igneous rocks, and that possibly there was *glacial drift* further south than had hitherto been suspected. I was to visit the region and report on its geology. As I returned home, in the southeast of the State, I called on Mr. J. W. Risley, of Humboldt, and examined specimens in his possession, but was unable to visit the exact locality. I was, however, convinced a geologic investigation would reveal something of interest to science. Three months later I found an opportunity to make the journey, and this time I had the privilege of going in company with Prof. Mudge. We spent the greater part of two days examining a district not exceeding three hundred acres in area. Some weeks after that I had the opportunity to talk over the matter again with our late beloved friend; and in June last, just twelve months after my first visit, I went over the ground again, accompanied by Prof. Middaugh, of Humboldt. The second visit scarcely revealed any new fact, but largely verified former notes, and I reproduce here a portion of an article from the Chetopa *Advance*, in which I gave an account of our first visit:

"The section corner where come together sections 28, 29, 32 and 33 of township 26, range 15, east, is very near the eastern extremity of a strip about a quarter of a mile wide and very nearly a mile long, extending mostly westward from the corner stone, and mostly on the south side of the section line running between 29 and 32. A very little of the region is in section 33. This may be called the southern terminus of a ridge of high prairie, having spurs southward and a lower level both east and western ends.

"We began investigation at the west. On the surface were some quartz fragments as if they had been seams in clay. A shaft showed a limestone about two feet thick, underlaid for many feet deep with slaty shale containing some mica. The limestone had fossils. Going east the limestone changed to a dark massive-looking rock, not unlike some igneous rocks, but the traces of fossils were still plain. Instead of shale there was a loose earth under, with more mica; the rocks still horizontal. Further east a higher level is obtained, and the surface rocks are quartzose; green mostly, and dipping at a considerable angle. The loose earth is now yellower, and further east nearly black, and is rich in mica. We called it micaceous dirt. We will retain that name. North and east of the limited region we are describing, the surface rocks of the high prairie are Coal-measure sandstone, mostly reddish. Here they are all altered into quartzite, green, and some dark, blackish, olive, but many retaining their horizontal position, and the stratification plain. Others are considerably tilted up, showing violent force in a very narrow area. About the middle of the south edge of the area, and again at the eastern end, there are

masses of brecciated rock, the uniting material being quartz. Here then we have, without doubt, metamorphic rock *in situ*—quartzite and breccia. About the middle of the north edge of the area is a shaft twelve feet deep, six or eight feet long, and five feet wide. It shows the metamorphosis beautifully. A mass of white quartzite, solid (but also in part greenish, with many pores and holes filled with crystals) and wedge shape downwards, looks at first as if it were injected material lying in a fissure of the rocks; but on looking carefully we find it is a metamorphism of the immediately adjoining sandstone, which at first is barely crystaline, but which can be traced through several stages distinctly to the massive white quartzite. In places this shows contortion. We judge, then, that the metamorphic agency (heat) has been applied here from above, and under great pressure, and up to the point of fusion. This shaft yields, among other quartzose crystals, beautiful amethysts, and some that may possibly be beryl.

"The deepest shaft is that of Mr. Van Meter, which we will call No. 1. It is 70 feet deep. It has 35 feet of water in it. We descended to the surface of the water. The rocks near the surface are the altered sandstones and limestones; below is the micaceous dirt (dark colored). This is crossed in all directions by seams of dark-blue (or purplish) stone of great hardness, from one to twelve inches thick, and below the dirt is now solid, and has thin quartzose bands in it. These quartzose bands, imbedded in very fine red clay, are further developed in shaft No. 2, about two rods to the north. This blue rock and these quartz bands (only one-half inch thick) are what the miners expect will yield silver or gold. We don't. In the Pucket shaft, further east, the shale of the west end reappears with laminæ of green carbonate of copper, and near the surface is brecciated rock.

"We regard the dark-blue rock as the expression of the igneous agency. We think it is true igneous rock. We think long before other rocks were removed from the surface, this was pushed up from below into cracks and fissures, probably finding here there was no outlet, in mass; but it may have ascended in places higher than the present surface, and spreading in small caverns altered patches of rock below it, and where there was room, causing a stream of half-melted material, which inclosed the fragments which now make the breccias. Again, the action of the heated material would be likely long to have effect on the waters, and the thin veins of quartz and the crystals are probably due to infiltration in the cracks that were made as the mass cooled, while the micaceous dirt is perhaps altered shale.

"We have not here stated every fact, nor attempted to indicate all their bearings, but we have given enough to show that we have here a geological fact in Kansas not before recognized by our scientific men—metamorphic and igneous rock *in situ;* and that the time of the metamorphic eruption (which had no real outlet) was after the laying down of these Carboniferous strata, and before the denudation of superincumbent strata. Further, possibly other traces of igneous action may be found in regions where the Carboniferous strata are thinner; possibly also in Cretaceous age, and where the Carboniferous rocks are thicker."

My last interview with Prof. Mudge was when we were journeying together from Holton to Valley Falls, in July, 1879. We talked over the whole matter, and he differed from me in what I deem an important inference from the facts we both knew. Of course I was anxious that he should agree with me, and I restated the case to him as plainly as I could. He listened with his usual patience, and when we had to part he spoke words eminently characteristic, and which I shall ever remember: "Well, I don't yet see it as you do, but I may change. I shall look the whole matter over again, and I may change. Some men never change; a wise man *must* change sometimes."

While Prof. Mudge and I were at Humboldt, a gentleman told us there was a trap dike in Linn county. I undertook to visit it as early as possible. Only a short time before his death, Prof. Mudge wrote, asking me had I been to Linn county. I had not then, but in December last I made the visit. There was no trap dike.

In conclusion, we would again call to mind the statement in the biennial report, that there is no metamorphic rock in Kansas, and ask your attention to the fact that the statement was scarcely published ere the author learned that there was, and followed up the discovery with zest.

Again, the rock specimens were in the hands of experts, who examined them in reference to the question of metal or no metal, but overlooked for a time the question, What led people to think there was metal there? Prof. Patrick, who has also visited Silver City, in Woodson county, pronounces that half-mile of land the most remarkable mineral district he has ever visited; and I, thinking the same, do not wonder that some uneducated men, seeing indications very like what we see in Colorado, should have become infatuated with the idea of finding the precious metals. They see resemblances—a lack of geological knowledge hinders them detecting differences.

Why do I mention these things? To suggest that if our State was thoroughly surveyed geologically, local reports could be investigated by a competent official before time and money were wasted in useless enterprises, and very probably knowledge would be obtained that could direct capital into useful and remunerative undertakings.

Further, we would suggest to local geologists to look out for signs of metamorphism and trap dikes. In other parts of the world to-day, and also in the geological ages, there have been igneous overflowings without extensive fracture, and this was not unknown in the Cretaceous period. These would cause local metamorphism and peculiar mineral conditions. Let the geologists of Labette, Cowley and other counties, besides looking for fossils and the line of outcrop, look also for crystaline structure and local faults, till we know more fully than we know now the Igneous Rocks of Kansas.

ARE THERE IGNEOUS ROCKS IN CHEROKEE COUNTY?

BY ERASMUS HAWORTH, EMPIRE CITY, KANSAS.

In the March number of the *Kansas City Review of Science and Industry*, the writer published an article entitled, "The Chert Rocks of Sub-carboniferous Kansas." In this article two points are particularly insisted upon: First, that the chert rocks have been deposited in layers, are true stratified rocks, and are not metamorphosed limestone; second, that there is not only no indication of volcanic action among those rocks, but that there is positive evidence to the contrary. It is also held that the reason given by Dr. Schmidt,

of St. Louis, for the numerous fractures in those rocks, is entirely inadequate. To avoid an unnecessary repetition, it has been thought best simply to exhibit characteristic specimens at present, and give to those interested the above reference for a fuller discussion of the subject.

Specimen No. 1 is a fragment of chert with fossil corals on one side. It has evidently been adjoining a limestone, as a number of the prominences on the fossiliferous side are limestone.

No. 2 is a specimen of what is locally called "cotton" rock. It exists very abundantly along the northwest limit of the Sub-carboniferous, particularly in Jasper county, Mo. It shows a mass of fragmental crinoid stems, one of which is fully six inches long; also a few other fossils common in this formation, among which is a trilobite.

No. 3 is a cherty rock with crinoids and other fossils.

No. 4 is a sample of what has been called volcanic tufa.

No. 5 is a specimen of the same, but in this small specimen, which weighs less than half a pound, there are more than fifty fossils.

No. 6 is a similar specimen.

No. 7 is a sample of decomposing chert, the center of which is still unchanged.

Nos. 8 and 9 are samples of rocks containing cavities from which crystals of sphalerite (*zinc blende*) have been removed.

Nos. 10, 11 and 12 are similar specimens, which still retain a portion of their crystals, although they have been strongly acted upon apparently by a solvent. These show conclusively that the crystals were formed prior to the formation of the rock around them; otherwise the crystals would have assumed the shape of the cavities in the rocks, which would not have corresponded exactly to the crystalline form of sphalerite.

No. 13 is a collection of sphalerite crystals, which also show the effect of some solvent. This specimen has not been above ground more than ten days.

Nos. 14 and 15 are specimens of galena crystals, partly removed by a solvent. The same may be said, with reference to the time of their formation, that was said when speaking of the sphalerite crystals. If we will now consider the great range of temperature between the fusing points of those two minerals and that of the surrounding rock, and also consider the invariable result of fusing lead and zinc ores with silica — that is, the formation of silicates — we will see at once that these, as well as the fossils, are positive evidence against the igneous origin of these rocks.

No. 16 is a fossiliferous chert rock, upon which calamine (*zinc silicate*) has been deposited, showing that the presence of this mineral is no evidence in favor of the igneous theory.

No. 17 is similar, only it shows that while the silicate was being deposited, the chert was being dissolved. This act is carried so far that the form of the chert rock is almost destroyed, but two fragmental fossils are still preserved.

Nos. 18 to 22 inclusive give some idea of the manner in which the chert is fractured.

Nos. 23 and 24 illustrate that which is often seen on a grand scale —alternating layers of chert and limestone. In specimen No. 3 there is strong indication of limestone having been silicified. The specimen shows three layers—an interior one, and two exterior ones. The interior one contains by far the greater number of fossils, and may thus have been more porous than the exterior ones. It would therefore have yielded more readily to silicifying waters, and it is possible that the whole of the specimen was at one time a limestone. The exterior portion is at present quite calcareous, even containing some carbonate. The theory advanced for the formation of great beds of chert, requires conditions quite favorable for such metamorphisms. They are not only possible, but altogether probable. But can anyone hold specimen No. 24 in his hand and say he thinks the chert in it was at one time limestone? Let me repeat: It only represents on a small scale that which exists on a large scale—alternating layers of chert and limestone. Specimens 21 and 22 are good arrow-head flint, but 22 has many crinoid stems in it.

No. 25 is a concretionary formation containing fossils. If this was formed in some cavity, how could those shells have been suspended in that cavity so that they would have been included in the central portion of the concretion? If those shells were originally included in limestone, why would such a peculiarly-shaped portion of that limestone have been silicified? If the limestone originally assumed this shape, why is it that similarly-shaped limestones are not found in localities where they have not been silicified? If they were fragments of limestone, water-worn until they became of this shape, why are the concentric layers so plainly marked? And why do some of them have small cavities along their major-axis? And why do some of them have two distinct centers around which the material has been collected, thus forming a true twin concretion?

FOSSIL WOOD.

BY ROBERT HAY, JUNCTION CITY, KANSAS.

Everybody in Kansas who has any collection of minerals or fossils, or merely a handful of so-called curiosities, is sure to have a piece of fossil wood. Inquiry develops the fact that the pieces were picked up on the high prairie, in a dry ravine, in a creek bed, on a river bottom, or in almost any conceivable situation. Some of these pieces are found *in situ*. They have been petrified at or near the spot where they were found by agencies now or very recently in operation. Elk creek, in Jackson county, yields petrifactions in the form of iron pyrites; while a small tributary of McDowell's

creek, in Davis county, is possessed of such a quantity of calcareous matter that it produces petrifactions of leaves and twigs in a few weeks or months.

The collectors of the curiosities will frequently tell you that the specimen you are examining is cottonwood, hickory, or sycamore wood. Some of them may be so, having been made by the more modern agencies referred to. But sometimes we pick up a piece that we call palm wood. This occurs most frequently on the western plains as far as Denver. We know that the palm has been petrified by no recent action. It has not grown here since the glacial epoch. Some of the larger specimens that are not palm are also as certainly not recent, but the geologic age to which they belong seems doubtful. We have a few facts that help to assign them to their true period.

The great advance that has been made in fossil botany through the discovery of numerous leaves in the rocks of the Dakota group and the lignitic series, has been as much through the labors of Professor Lesquereux as of any other man, or perhaps any two men; and yet in a communication from him, received by the writer during the past summer, the distinguished professor says he has no means of identifying fossil wood. Let us remember that the leaves and fruits we have plucked from Dakota forests are not associated with the trunks that bore them aloft in air, hence our ignorance of the structure of the various species of wood that must have existed. But it may be that we are on the confines of positive knowledge on the subject. The writer has in his possession a slab of sandstone from Ottawa county, which, besides other forms, has on it two leaves (not perfect, but very large) of *sassafras mirabile*, connected and separated by parts which are manifestly the remains of the twig or twigs on which the leaves grew. This stone, subjected to the examination of a compent *histologist*, would give us the structure of this Cretaceous sassafras in its woody fiber.

On the north line of Dickinson county, in a broad ravine, is a bluff of stratified sand almost solidified into stone, which has a tertiary facies, but which is overlaid by the fiery-looking ironstones of the Dakota. Out of this bluff, which has been worked as a sand quarry, some time ago there projected the base of the trunk of a tree, about two feet in diameter. Collectors have carried it away in parts, gradually digging into the face of the bluff, till there is now a horizontal excavation of about fifteen feet, and yet the top of the trunk has not been reached. The writer has portions of the wood and bark that show a diameter of about eighteen inches, from twelve feet in the cave. If this excavation is carried forward, branches and twigs may be reached, and if a leaf or carpel should be attached, we should have something from which to determine accurately at least one kind of Dakota wood. If such Dakota wood was petrified in more durable forms, it would not be improbable that in the localities of great denudation some of the harder specimens should survive the friction of ages. Some of the specimens of fossil wood we have seen, we are inclined to believe, are from the Dakota, though they are found on the high prairie, far away from the present Cre-

taceous areas. The rocks above Junction City are decidedly Permian, yet in little gullies among them we have found hard, siliceous ironstone pebbles that tell of the Dakota strata, long since vanished.

Some of the specimens of fossil wood are of siliceous limestone, with occasionally the silica very small in quantity, and the specimen might almost be described as hard chalk. This class has more numerous specimens than the kind we should be inclined to attribute to the Dakota. Till recently we inclined to refer these to recent action of water percolating through Cretaceous or Permian limestones, on recent wood imbedded in their crevices or in sedentary soils. Two specimens found last August have led to a change of this opinion.

In a ravine leading northward to the Saline river, in Russell county, we picked up one of these limestone petrifactions that had such a resemblance to the Benton rocks around that it induced further search, which was rewarded beyond possible anticipation. On a projecting ledge, and forming part of a stratum above it that was considerably weathered, I observed some impressions of shells. The piece of which they formed a part, though large, easily broke off, and the under side was entirely petrified wood, the fibres and cells being shown in both longitudinal and cross-sections as distinctly as in the large Dakota tree of Dickinson county. Here was a piece of a log that floated in the early Benton Sea, over the enormous Inocramus bed, and becoming weighty with water, dropped down among shells, and in the lapse of œons since has become like them, a part of the solid limestone. We know it was the early Benton, because a little way further down the ravine we came to an outcrop of the soft, light-colored sandstone which often forms the upper horizon of the Dakota.

The facts we have narrated are significant. We believe they all point one way, viz., to the Cretaceous origin of most of the specimens of fossil wood found on our prairies. They also point to the desirability of submitting a series of these specimens to competent histological examination, so that by comparison with modern wood tissue the genera, if not the species, might be defined. It would be a beautiful result, but one that we should be led to expect, if such investigation referred the fossil woods to species of platanus, sassafras, quercus, salix and laurus, that have left their leaves impressed so fairly and in such multitudes on the sands of the Dakota shores.

METEOROLOGICAL SUMMARY FOR THE YEAR 1881.

(From observations taken at Lawrence.)

BY PROF. F. H. SNOW, OF THE STATE UNIVERSITY OF KANSAS.

The most marked meteorological features of the year were the severe and prolonged winter; the extremely late spring; the excessive and long-continued heat of the summer, extending even into October; the delay of the first severe frost of autumn until nearly the middle of November, resulting in the unseasonable blossoming of many fruit and flowering trees and shrubs; and the unusual warmth and fine weather of December. The total rainfall was nearly equal to the average amount. The rain deficiency in July and August reduced the corn crop to about half the average yield, but the consequent high prices have in most cases more than compensated for the reduction.

TEMPERATURE.

Mean temperature of the year, 54.65°, which is 1.31° above the mean of the thirteen preceding years. The highest temperature was 104°, on August 11th and 25th; the lowest was 8° below zero, on the 9th of January, giving a yearly range of 112°. Mean at 7 A. M., 48.87°; at 2 P. M., 63.52°; at 9 P. M., 53.12°.

Mean temperature of the winter months, 29.16°, which is 0.92° below the average winter temperature; of the spring, 53.27°, which is 0.74° below the average; of the summer, 79.41°, which is 3.02° above the average; of the autumn, 56.75°, which is 3.86° above the average.

The coldest month of the year was January, with mean temperature 21.60°; the coldest week was January 8th to 14th, with mean temperature 14.45°; the coldest day was January 9th, with mean temperature 1.5° below zero. The mercury fell below zero six times during the year—three times in January, and three times in February.

The warmest month was August, with mean temperature 81.23°; the warmest week was July 5th to 11th, with mean temperature 85.09°; the warmest day was August 17th, with mean temperature 89.7°. The mercury reached or exceeded 100° on fourteen days, of which three were in July and eleven in August; the mercury reached or exceeded 90° on sixty-eight days, viz., nine in June, eighteen in July, twenty-six in August, fourteen in September, and one in October.

The last light frost of spring was on April 15th; the first light frost of autumn was on September 25th, giving an interval of 193 days (more than six months) entirely without frost. The last severe frost of spring was on April 13th; the first severe frost of autumn was on November 9th, giving an interval of 210 days (nearly seven months) without severe frost. No

frost during the year damaged fruit buds or trees, but winter wheat was injured in some localities by the severe cold of the first half of April.

RAIN.

The entire rainfall, including melted snow, was 33.27 inches, which is slightly above the precipitation of 1879 and 1880, but 1.31 inches below the average rainfall of the thirteen preceding years. Either rain or snow (or both) fell on 110 days—seven more than the average. On nine of these days the quantity was too small for measurement. The longest interval without rain during the growing season (March 1st to October 1st) was fourteen days—from July 29th to August 12th. The number of thunder showers was thirty-one. There were three hail storms, of which one occurred in April and two in September. The hail of September 29th were very large and destructive.

SNOW.

The entire depth of snow was 32.50 inches, which is 12.06 inches above the average. Of this amount, half an inch fell in January, twenty-two inches in February, one inch in November, and one inch in December. The last snow of spring was on April 12th; the first snow of autumn was on November 18th.

FACE OF THE SKY.

The average cloudiness of the year was 47.52 per cent., which is 3.43 per cent. above the average. The number of clear days (less than one-third cloudy) was 157; half-clear days (from one-third to two-thirds cloudy), 95; cloudy (more than two-thirds), 113. There were 79 days on which the cloudiness averaged 80 per cent. or more. There were 37 entirely clear, and 55 entirely cloudy days. The clearest month was July, with a mean of 26.23 per cent.; the cloudiest month was May, with a mean of 64.08 per cent. The mean cloudiness at 7 A. M., was 52.56 per cent.; at 2 P. M., 50.25 per cent.; at 9 P. M., 39.75 per cent.

DIRECTION OF THE WIND.

During the year, three observations daily, the wind was from the N. W. 280 times; S. W., 276 times; S. E., 139 times; S., 110 times; N. E., 116 times; E., 95 times; N., 72 times; W., 6 times; calm, once. The south winds (including southwest, south and southeast) outnumbered the north winds—including northwest, north and northeast—in the ratio of 525 to 468.

VELOCITY OF THE WIND.

The number of miles traveled by the wind during the year was 141,430, which is 3,383 miles above the annual average for the eight preceding years. This gives a mean daily velocity of 387.48 miles, and a mean hourly velocity of 16.14 miles. The highest velocity was 60 miles an hour, on February 11th and March 31st. The highest daily velocity was 1,010 miles, on March 4th; the highest monthly velocity was 16,231 miles, in March. The three windiest months were March, April and November; the three calmest months

were May, July and August. The average velocity at 7 A. M, was 14.48 miles; at 2 P. M., 17.51 miles; at 9 P. M., 15 46 miles.

BAROMETER.

Mean height of barometer column, 29.103 inches; at 7 A M., 29.125 inches; at 2 P. M., 29.081 inches; at 9 P. M., 29.104 inches. Maximum, 29.722 inches, on January 26th; minimum, 28.305 inches, on March 11th; yearly range, 1.417 inches. The highest monthly mean was 29.255 inches, in January; the lowest was 28.769 inches, in June. The barometer observations are corrected for temperature and instrumental error.

RELATIVE HUMIDITY.

The average atmospheric humidity for the year was 70.12; at 7 A. M., 80.14; at 2 P. M., 53.36; at 9 P. M, 76.88. The dampest month was February, with mean humidity 79.8; the driest month was September, with mean humidity 60.76. There were eleven fogs during the year. The least humidity for any single observation was 16.1, at 2 P. M. on the 24th of September—less than one-sixth of saturation.

The following table gives the mean temperature, the extremes of temperature, the velocity of the wind, the percentage of cloudiness, the relative humidity, the rainfall (including melted snow), and the depth of snow, for each month of the year 1881.

1880.	*Mean temperature.*	*Max. temperature.*	*Min. temperature.*	*Miles of wind.*	*Relative humidity.*	*Rain, inches.*	*Snow, inches.*	*Mean cloudiness.*
January	21.60	53.0	*-8.0	12,192	75.90	0.34	0.5	58.60
February	25.78	61.5	-5.5	12,142	79.80	4.60	22.0	54.17
March	37.47	77.0	14.0	16,231	70.30	1.66	8.0	45.79
April	52.47	84.0	13.0	14,495	67.60	1.27	.....	51.78
May	69.86	88.5	48.0	8,868	72.47	3.51	.....	64.08
June	77.25	97.0	62.5	11,474	70.10	4.52	.....	31.89
July	79.74	102.0	57.5	7,541	72.50	2.28	.....	26.23
August	81.23	104.0	62.0	7,991	62.50	1.57	.....	31.29
September	70.59	99.0	42.5	11,722	60.76	5.72	.....	43.89
October	59.27	91.0	39.5	12,189	74.25	4.85	.....	61.72
November	40.40	71.5	11.0	13,906	66.99	2.55	1.0	45.55
December	40.10	63.0	18.0	12,679	68.30	0.90	1.0	55.26
Mean	54.65	82.6	31.1	11,786	70.12	2.77	2.7	47.52

*The minus sign denotes temperature below zero.

NOTES ON KANSAS MINERALS.

BY ERASMUS HAWORTH, EMPIRE CITY, KANSAS.

The following minerals, *new to Kansas*, have been found in Cherokee county:

1. Native sulphur. 2. Chalcopyrite (copper pyrites). 3. Greenockite (cadmium sulphide). 4. Anglesite (lead sulphate).

1. Native sulphur occurs at Weir City, and in other coal-mining districts. The "dumps" at the coal shafts take fire spontaneously, and the heat decomposes a portion of the iron pyrites, the sulphur from which is votilized, and

condenses at or near the surface of the dump-pile. Needle-shaped crystals, fully ⅔ c. m. in length, have been seen.

2. Chalcopyrite (copper pyrites) occurs in perfect tetrahedral crystals, which are generally — though not always — adhering to zinc blende. They vary in size from 1 mm. to ⅔ cm. in thickness. It is quite common in three or four shafts in the Short Creek lead mines, and a few specimens of it have been obtained from Joplin, Missouri, although its occurrence at Joplin is not mentioned by Prof. Leonhard in his "Notes on the Minerals of Missouri."

3. Greenockite (cadmium sulphide) has been found in a number of different shafts in the Short Creek mines, occurring as a yellow, or yellowish-green, incrustation. It gives to some brilliant sphalerite crystals a most beautiful appearance. No crystals have yet been found.

4. Anglesite (lead sulphate) is found adhering to galena. (*Rare.*)

PROTOZOAN REMAINS IN KANSAS CHALK.

BY PROF. G. E. PATRICK, OF THE STATE UNIVERSITY.

At the meeting of the Academy in 1875, I presented a paper upon "Kansas Chalk," then a recent discovery, and then first brought before the scientific world as the only known chalk in North America.

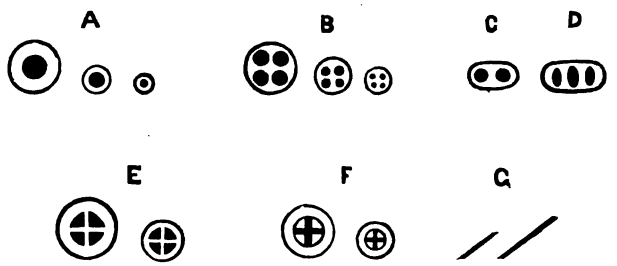
In that paper, after speaking of the chalk chemically and industrially, I stated that, with the highest microscopic power at my disposal, I had been unable to detect organic remains; and being of opinion that said power was sufficiently high for the purpose, favored the theory of chemical precipitation in accounting for the formation of this chalk. It has turned out, however, that a higher magnifying power alone was needed to render visible forms of undoubted organic origin. This was shown during last year (1882) by Mr. W. S. Bunn, a student at the University, and the possessor of a good microscope with an objective of much higher power than that previously used by myself.

Mr. Bunn made out two forms, one circular, the other rod-like, and *thought* he detected dark spots on some of the circular ones. He intended making further observations with a higher power than he then possessed; but being called away from the University, and having been since engaged in pursuits of a quite different character, he has given the subject no further attention, except to request me to report his observations to the Academy, together with any others that I might be able to make.

My own facilities for observation are no better now than when I originally examined the chalk; but through the kindness of Prof. E. A. Popenoe, I have had the use of an immersion lens of $\frac{1}{16}$-inch focal length, by means of which a few details were rendered visible which it may be worth while to describe here:

The circular forms (disks) observed by Mr. Bunn were found not all to

be circular, part (a relatively small number) being decidedly oblong. The circular ones were marked with either one or four spots (figs. *a* and *b*); the oblong ones with two or three (figs. *c* and *d*). The single spot in a circular figure was itself apparently circular; the four spots in some appeared circular or roughly rounded (*b*), while in others they were plainly quadrants of a circle (*e*). From my working notes I take the following: "Circles light, spots black (as in *b* and *e*); changing the focus slightly, the spots become red; changing the focus still more, they become light, and the portion of circle between them becomes black, making dark cross on light ground" (as in *f*).



An expert microscopist could, I doubt not, interpret these appearances, and draw from them accurate and complete conclusions regarding the structure of the objects. This I freely confess I cannot do. However, I infer—more from appearances under a lower power than from these—that the dark spots are either actual holes, or else consist of a very transparent medium. The red color developed in the spots at a certain position may have been caused by either absorption or refraction, and may perhaps be accounted for by the conditions of observation. The objects and objective were both immersed in glycerine, and the light was from an argand gas-burner. With natural light, I do not remember having seen the red color.

The spots on the oblong figures were either circular (*c*) or oblong (*d*); when there were three, they were oblong in every case I observed.

No details could be made out upon the rod-shaped forms; they were simply rods (*g*) of different lengths, and comparatively rare.

With a stage micrometer I made approximate measurements. The circular and oblong forms varied much in size—a fact evident at first glance without a micrometer. The very largest were about $\frac{1}{2000}$ inch in diameter, many had a diameter of about $\frac{1}{3000}$ inch, and many of no more than one-half (possibly as low as one-third) this figure. The rods were in length one to three times the diameters of the larger disks.

The figures in the cut give an idea of the *relative* sizes of the objects described; they are of two or three times the *apparent* diameter with the one-sixteenth objective employed.

The perfect forms here described were somewhat rare, fragments and shapeless masses constituting the greater part of the material examined.

OBSERVATIONS OF COMET "B," 1882.

BY PROF. H. S. S. SMITH, UNIVERSITY OF KANSAS.

The present equipment of the observatory of the State University does not permit of measurement of positions out of the meridian, nor of spectroscopic investigations, nor of photographic work. Being thus necessarily limited in my scope of work, nothing remained but to do the best that I could with the means at my disposal. Attention has been entirely directed to observing the appearance and changes of the comet, and the attempt has been made to make drawings of such features as would warrant it. The telescope used is a comet-seeker, having an object glass five and five-eighths inches in diameter, and a focal length of forty-two inches. The tube is bent so that the eye-piece is always horizontal, the reflector being a right-angled prism. It was found that the power of fourteen was best suited to show the faint portions, as the prism absorbs so much light that they could not be examined satisfactorily with the higher powers. No attempt was made to study the nucleus or the coma critically, as it was evident that the telescopic power was not sufficient for the purpose. Chief attention was given to the fainter portions, and the results seem to repay the labor expended.

EYE OBSERVATIONS.

On September 26th I first saw the comet, and it was then low down in the horizon. The nucleus was estimated to be as bright as Procyon. The tail was about five and a half degrees in length, and was bright enough to be seen until twenty minutes before sunrise. The nucleus became invisible five minutes later. On October 9th the comet was very bright. The tail was fifteen degrees long, the south side was much better defined than the north, and on the south side of the end there was a projection about half a degree long in the direction of the tail. On October 13th the south edge was quite well defined, while the north edge faded gradually away. A faint hazy appearance was seen along the north side of the coma. Near the end of the tail and on the south side there was an appearance of twisting, and there seemed to be a tendency toward a forked arrangement of the end. On October 14th the tail was bright and long, poorly outlined on the north, sharply on the south. The twist in the end of the tail was less prominent, but the forked appearance was more noticeable. The haze on the north side of the head was seen to be extended in front of the coma. The nucleus was more star-like than on previous days. On the 15th the tail had broadened perceptibly on the northern side. The end was less twisted and more nearly even than before, but it was still noticeably forked. The nucleus was more star-like, but less brilliant. Two days later the comet had not changed much.

The twist in the tail was quite prominent, and the forked appearance was distinct. On the 19th there was but little change to be seen. The next morning the tail appeared shorter and broader, the twist not prominent, and the end more even. The nucleus was decidedly less brilliant. On the 21st the tail was broader. On the 22d the coma and nucleus showed unmistakable signs of being smaller and fainter. The tail was much the same as on the two previous days. On the 23d the tail was much broader near the end than anywhere else. The end was but slightly uneven. The head was small. On November 5th the comet was much less brilliant than on former days. Nucleus was small but brilliant. Tail was much broader than before, and brightest along the south edge from the head to the middle of its length.

TELESCOPIC OBSERVATIONS.

On October 9th the nucleus was granular and elongated in the direction of the tail. Along the north side of the coma, between 20′ and 25′ from the nucleus, and running parallel, or nearly so, to the center line of the tail, there was a faint streak of light quite distinctly bounded on the north side, but fading gradually away toward the comet proper. The brilliancy was not greater than that of the tail at its apparent termination. This faint streak of light extended toward the sun fully one-half a degree from the nucleus, but its end was illy defined. On the south side of the coma there was a similar but fainter streak of light about 15′ from the nucleus, parallel to the axis, and extending 15′ toward the sun. Both of these streaks extended westward from the nucleus until they met the tail, where it was broad enough to equal the distance between them. On October 13th the streaks were apparently a little longer in the direction of the axis, but were at the same distances from the nucleus. The haze between them extended across in front of the nucleus. The brighter part of the tail was enveloped in a thin haze, and the streaks were a forward continuation of it. On October 14th the eastern haze was longer and brighter, the sides were decidedly parabolic in form, but the eastern end was poorly outlined. On the 15th the appearance was much the same, though the haze was longer and broader. It was quite uniform in texture, and faded away gradually toward the east. By the 17th the brightness of the haze had become less, though the size remained nearly constant. The edges were brighter than the central parts, and extended in the form of two short, straight horns. On the 20th the size was about the same, but the edges were more nearly straight, the eastern end was very poorly defined, and the brightness very much reduced. On the 21st, 22d and 23d the haze gradually lost its brightness, but the size remained about the same. It was last seen on October 25th, when it was exceedingly faint, and presented nearly the same appearance as when it was first seen on the 9th. The observations on the decrease of this haze seem to show that it became invisible through the lessening of its light, rather than by a diminution of its size.

STANDARD TIME.

BY PROF. H. S S. SMITH, UNIVERSITY OF KANSAS.

In bringing this subject before the Academy, it is not my intention to discuss it generally, but to note briefly what has already been done in this country toward the introduction of uniform standards, and to consider some points connected with its introduction into our own State. With the simple mention of the fact that in England and Scotland every one uses Greenwich time, let us see what has been done in this country. We have no system of standard time. The fact is, that there are more than seventy-five different standards in use by the different railroads; and besides these, there are the innumerable local times in use by the various towns and cities. Those standards that are in use over extended districts must, of course, be kept accurately, and where this has been done satisfactorily, the use of the standard has gradually spread.

There are now ten observatories that send out time-signals regularly for railroad or for general use. They are—

1. Harvard College observatory, Cambridge, Mass.
2. Yale College observatory, New Haven, Conn.
3. Dudley observatory, Albany, N. Y.
4. National observatory, Washington, D. C.
5. Allegheny observatory, Allegheny, Pa.
6. Cincinnati observatory, Mt. Lookout, Ohio.
7. Dearborn observatory, Chicago, Ill.
8. Washington University observatory, St. Louis, Mo.
9. Morrison observatory, Glasgow, Mo.
10. Carleton College observatory, Northfield, Minn.

The principal times employed are these:

1. Boston time, on the railroads of New England.
2. New York time, in Connecticut by law, and on most of the railroads that run to New York.
3. Philadelphia time, over the Pennsylvania Railroad and its branches.
4. Washington time.
5. Chicago time, on most of the railroads that center there.
6. Jefferson City time, over most of the railroads in Kansas and Missouri.
7. Northfield time, over more than 5,500 miles of railroad in the Northwest.

The only advantage that can arise from this multiplicity of standards is the nominal satisfaction of having the sun cross the meridian when the clock strikes twelve. That this satisfaction is merely nominal, can be proved from the condition of affairs in this very city (Topeka). Local time is here about sixteen minutes slower than the railroad time that is used. When the real

sun is slow and behind the average sun, the difference between apparent sun time and railroad time is more than half an hour, and yet no one notices the difference. The only advantage gained by a multiplicity of standards, and we have seen that it is purely nominal, is the only disadvantage of a standard common to a wide area.

The advantages that would accrue to navigation, railroad interests, newspaper dispatching, telegraphic communications of all kinds, scientific observations, and other similar but more general interests, can be fully realized only from a wide extension of a common system. In a State the advantages are more personal. Sixty minutes make an hour. Five minutes here and ten there, wasted because two railroads differ in their standards, will soon amount to considerable lost time. If the local time is slower than the railroad time, the forgetting this fact may involve a full day's delay. Persons coming from Lawrence to Topeka find that their watches are a quarter of an hour slow. The journey from Topeka to Wyandotte involves a change of twelve minutes in the other direction. While these may seem trivial concerns, they have, in reality, a decided influence on the convenience of most people.

Should a system of common time be established in this State, as has been done in Connecticut, the selection of the proper meridian would be one of the first questions to be settled. In doing this, regard must be had, not alone to the convenience of the majority and to State feeling, but also to the fact that it is quite probable that within a few years there will be established a system extending over the whole country. The outline of the plan is that there shall be four "times," differing by even hours, and in use respectively in the Atlantic States, the Mississippi valley, the Rocky Mountain region, and the Pacific States. The leaders in the movement have not yet determined which of the two principal meridians (Greenwich or Washington) shall be chosen as the base. It would seem that the meridian of Greenwich would be the better.

The six meridians that are available for use in this State are these:

1. The meridian of the observatory of the State University, at Lawrence, where the time would be determined and sent over the State.
2. The meridian of the State Capitol building, at Topeka.
3. The meridian of Kansas City—the practical commercial focus of the State.
4. The meridian that is one hour west of Washington.
5. The meridian that is six hours west of Greenwich.
6. The meridian that is seven hours west of Greenwich.

These times will be in error, as compared with true local times at the eastern and western boundaries of the State, as follows:

	East.	*West.*
1. Lawrence meridian	2 m. slow.	28 m. fast.
2. Topeka meridian	4 m. slow.	26 m fast.
3. Kansas City meridian	0 m.	30 m. fast.
4. Washington (one hour) meridian	11 m. fast.	41 m. fast.
5. Greenwich (six hours) meridian	19 m. fast.	49 m. fast.
6. Greenwich (seven hours) meridian	41 m. slow.	11 m. slow.

After weighing the matter carefully, I should say that the meridian that is six hours west from Greenwich will be most likely to be convenient for general use in Kansas. While the differences between this and true local times are larger than for any other meridian, the fact that its use would connect us with the whole Mississippi valley, bears strongly in its favor.

BOTANICAL ADDENDA FOR 1881 AND 1882.

BY PROF. J. H. CARRUTH, LAWRENCE.

Since my last report, two of my botanical correspondents, for whom I had a high regard, have been called away: Mrs. E. C. Jewell, of Irving, Kas., and Mr. Elihu Hall, of Illinois.

In my last report, I inadvertently put *Conioselinum* for *Conoclinium*. I have learned that *Gaura mollis* and *Gaura parviflora* are the same. *Trillium erectum*, in my last report, proves to be *T. sessile* L.

At the meeting of the State Horticultural Society in 1879, the delegates from twenty-one counties reported white ash, *Fraxinus Americana*. At the meeting the next year, some members maintained that the green ash had been mistaken for white ash, and that we had no white ash. A careful and extensive examination the season past has satisfied me that we have white ash.

The additions now made are but few. The field has been reaped, and henceforth I can only give the gleanings. Of one package sent away last spring for examination, I have no returns. In August last I visited Lyon, Morris, Greenwood, Sumner, Rice, Stafford and Barton counties, and though I became better acquainted with many plants, I found but few new ones. Mr. Plank, of Independence, has made a thorough survey of Montgomery county, but his collection has not been thoroughly examined. Mr. E. Bartholomew, of Rockport, Rooks county, has explored that county the past season, and sent me his doubtful specimens. The few that I cannot determine, I cannot send away and get returns from for this report. Dr. J. H. Oyster, of Paola, has also sent a few.

1438 Cardamine hirsuta L. Lawrence; found by students.
1439. Solea concolor Ging. Reported from La Cygne.
1440. Æsculus parviflora Walt. Independence.
1441. Lathyrus pusillus Ell. Ind.
1442. Lespedeza procumbens Mx. Not before distinguished from L. repens.
1443. Psoralea lanceolata Ph. Rooks county.
1444. Crotallaria ovalis Ph. Ind.
1445. Melilotus officinalis Willd. Emporia and Topeka.
1446. Ludwigia arcuata Walt. Ind.
1447. Œnothera rhombipetala Nutt. Rooks county.
1448. Passiflora incarnata L. Ind.

1449. Heracleum lanatum L. Reported from Paola by Dr. Oyster.
1450. Grindelia ciliata. Described in Loudon. Found in Lawrence, and reported doubtfully in last report. Common in Rice and Barton counties.
1451. Inula helenium L. One specimen seen in Lawrence.
1452. Rudbeckia fulgida Ait. Ind.
1453. Actinella acaulis L. Rooks county.
1454. Senecio vulgaris L. Rooks county.
1455. Bumelia tenax Willd. Ind.
1456. B. lycioides Gaert. Sumner county.
1457. Plantago cordata Lam. Found in Douglas county by Prof. Snow.
1458. Myosotis verna Nutt. Found in Douglas county by students.
1459. Ipomea ciliolata Pers. Greenwood county.
1460. Asclepias brachystephana Eng. Rooks county.
1461. Asarum Canadense L. Reported from Johnson county by two persons.
1462. Chenopodium murale L. Lawrence.
1463. Echinodorus radicans Eng. Emporia.
1464. E. parvulus Eng. Near Bismarck.
1465. Juncus marginatus L. Douglas.
1466. Fuirena squarrosa Mx. Near Arkansas river.
1467. F. pumila sp. or var? Near Arkansas river.
1468. Scirpus pungens Kohl. Near the Arkansas.
1869. Parpalum latifolium Le Conte. Near the Arkansas.
1470. Eragrostis oxylepis Torr. Stafford county.
1471. Aspidium Nov-Eboracense Willd. From Wamego.
1472. Acacia filicina Willd. Independence.
1473. Scirpus maritinus L. Near the Arkansas.

A PRELIMINARY NOTICE OF THE FLORA OF MONTGOMERY COUNTY.

BY E. N. PLANK, INDEPENDENCE, KANSAS.

Montgomery county, which was, or should have been, named for Colonel James Montgomery, the noted Kansas Jayhawker, is one of the southern tier of counties, and third from the Missouri line. The thirty-seventh parallel forms its southern boundary, and its west line extends nearly to the ninety-sixth meridian. The county is not a large one, being only twenty-seven miles in extent from north to south, and twenty-four miles from east to west. In various parts of the county, ridges or mounds, the remains probably of a former elevation of the country, rise perhaps two hundred feet above the surrounding prairie. These mounds give us a flora similar to that of the country one or two hundred miles west of us.

Thinking that I might learn as much by confining my labors to a single county as by traveling over a larger extent of country during the botanical season of 1881, and especially during that of 1882, I have given my spare

time to a study of the flora of this county. For this purpose I have visited every township and school district in it—standing on its highest mounds and going into its deepest valleys and ravines.

Hoping to find time during the coming year to prepare and publish a catalogue of the plants of this county, at this time a few general observations must suffice. I have found growing in this county over a thousand species of flowering plants and ferns, and shall have a plant for every name reported; all of which I have seen growing, and which, with perhaps a half-dozen exceptions, I have gathered with my own hands. These plants represent over ninety orders, and more than three hundred and fifty genera. It is about as large a number of plants as are reported in Coulter's and Porter's Flora of Colorado, three-fourths as many as have been reported as growing in Kansas, and more than one-fourth as many as have been found in the entire United States east of the Mississippi river. We have about seventy-five species of climbing plants, and over one hundred species of shrubs and trees.

Our flora is rich in species of Cruciferæ, Leguminosæ, Umbelliferæ, Compositæ, Scrophulariaceæ, Labiatæ, and in Gramineæ. We have at least a hundred and twenty-five species of grasses, native and naturalized; nearly as many as have been found in all Kansas.

We are so far south that a few plants from the extreme southern portion of the country have ventured to emigrate here, and are trying to make a permanent home with us. Among these are *Acacia filicina*, Willd. (occasionally found on the mounds), and more rarely *Cooperia Drummondii*, a Texan member of the Amaryllis family.

Other interesting plants, whose range botanists may be glad to learn, grow here, among which are—

Acer saccharinum, Wang.
Sapindus marginatus, Willd.
Æsculus parviflora, Walt.
Stylosanthes elatior, Swartz.
Gnaphalium purpureum, L.
Centaurea Americana, N.
Passiflora incarnata, L.
Lobelia cardinalis, L.
Castilleia coccinea, Spring.
Monarda punctata, Le.
Eryngium Leavenworthii, Torr. & Gray.
Quamoclit coccinea, Mœnch.
Gilia coronopifolia, Pers.
Sabbatia campestris, Nutt.
Solanum alæagnifolium, Cav.
Comandra umbellata, Nutt.
Phoradendron flavescens, Nutt.
Acorus calamus, L.
Muhlenbergia capillaris, Ruth.
Gymnopogon racemosus, Beauv.
Chloris verticillata.
Camptosorus rhizophyllus, Link.

LISTS OF LEPIDOPTERA AND COLEOPTERA,

COLLECTED IN NEW MEXICO BY THE KANSAS UNIVERSITY SCIENTIFIC EXPEDITIONS OF 1881 AND 1882.

BY PROF. F. H. SNOW, OF THE UNIVERSITY OF KANSAS.

The following lists represent the entomological portion of the work of our expeditions to New Mexico for the month of August, 1881, and the two months of July and August, 1882. The party for 1881 consisted of Prof. H S. S. Smith, the writer, his twelve-year-old son Willie, and Mr. L. L. Dyche, his capable assistant in natural history. The locality selected for exploration was in the southern portion of the Territory, in the beautiful Water Cañon, some twenty-five miles west from Socorro. But the work of the month was seriously crippled by a hostile incursion of the murderous Apaches, who compelled us, after only five days of successful collecting, to abandon the locality, and select a safer but less desirable field for investigation. A single day was spent at Deming, and the rest of the month at Socorro and Pécos. Near the latter place a week was profitably devoted to archæological explorations.

In 1882 the expedition was more successful. The party consisted of the writer and his family, together with Mr. L. L. Dyche, Miss Mary Dyche, and Mr. W. W. Russ, students of the University. Our camp was fixed in the Gallinas Cañon, near the Las Vegas Hot Springs, and a more favorable locality could hardly have been selected. In his report upon the Coleoptera collected in Santa Fé Cañon in 1880, published in the last volume of these Transactions, the writer noted the conspicuous scarcity in that locality of certain families of Coleoptera, and of all the Lepidoptera, as probably due to the destruction of their food-plants by the sheep and goats. But in the Gallinas Cañon, not more than thirty miles distant, we found a sort of naturalist's paradise. The occupancy of the mouth of the cañon by the hotels and bathing-houses of that famous sanitarium, has proved an effectual barrier against the entrance of troublesome ruminants, and the entomologist and botanist is able to obtain the choicest of his favorite objects of study in delightful variety and perfection. From this camping-place as a center of observation, at an elevation of about 7,000 feet above the sea, we collected in nine weeks 277 species of Lepidoptera and 417 species of Coleoptera. Adding the material obtained in southern New Mexico in the preceding year, we have a total of 315 species of Lepidoptera and 514 species of Coleoptera. Among these forms, seventeen species of Coleoptera and fifty-three species of Lepidoptera—nearly one-tenth of the entire number—are new to science. A portion of the new Lepidoptera are described in a separate article in these

Transactions, by A. R. Grote, of New York. The new Coleoptera will be described by Dr. LeConte, of Philadelphia. My special acknowledgments are hereby made to these gentlemen, and to Mr. W. H. Edwards, for valuable aid in the determination of species. The letter appended to each species gives the locality of collection—G., W. and S. indicating, respectively, Gallinas Cañon, Water Cañon, and Socorro.

LEPIDOPTERA RHOPALOCERA (BUTTERFLIES).

Papilio Daunus *Edw.* G. W.
Papilio Rutulus *Bd.* G. W.
Pieris Menapia *Feld.* G.
Pieris Sisymbri *Bd.* G.
Pieris oleracea *Bd.* G.
Pieris occidentalis *Reak.* G.
Pieris Napi var. pallida *Scud.* G.
Nathalis Iole *Bd.* G. W.
Anthocaris Ausonides *Bd.* G.
Anthocaris Thoosa *Scud.* G.
Callidryas Eubule *L.* W.
Colias Cæsonia *Stoll.* G. W.
Colias Eurytheme *Bd.* G.
Terias Nicippe *Cram.* W.
Terias Mexicana *Bd.* W.
Danais Archippus *Fab.* G. W.
Danais Berenice *Cram.* G. W.
Argynnis Alcestis *Edw.* G.
Argynnis Eurynome *Edw.* G.
Argynnis Electa *Edw.* G.
Euptoieta Claudia *Cram.* G. W.
Melitæa Nubigena *Behr.* G.
Melitæa minuta *Edw.* G.
Melitæa Fulvia *Edw.* H.
Phyciodes Nycteis var. G.
Phyciodes Tharos var. Marcia *Edw.* G.
Phyciodes Tharos n. var. G.
Phyciodes picta *Edw.* W.
Phyciodes Camillus *Edw.* G.
Synchloe Crocale *Edw.* W.
Grapta Zephyrus *Edw.* G. W.
Vanessa Antiopa *L.* G.
Vanessa Californica *Bd.* G.
Vanessa Milberti *Godt.* G. W.
Pyrameis Huntera *Drury.* G. W.
Pyrameis cardui *L.* G. W.
Limenitis Weidemeyerii *Edw.* G. W.
Heterochroa Californica *Butler.* W.
Neonympha Henshawii *Edw.* G. W.
Coenonympha ochracea *Edw.* G.
Erebia epipsodea *Butler.* G.
Hipparchia Ridingsii *Edw.* G.
Satyrus Meadii *Edw.* W.
Satyrus Charon *Edw.* G.
Satyrus Nephele *Kirby.* G.
Chionobas Uhleri *Reak.* G.
Nemeobius Nais *Edw.* G.
Thecla Crysalus *Edw.* G. W.
Thecla Calanus *Hubn.* G.
Thecla Apama *Edw.* G.
Thecla Siva *Edw.* G.
Thecla Behrii *Edw.* G.
Thecla Eryphon *Bd.* G.
Chrysophanus Ianthe *Edw.* G.
Chrysophanus helloides *Bd.* G.
Lycæna orbitulus *Von Pr.* G.
Lycæna Lygdamas var. Oro *Scud.* G.
Lycæna Melissa *Edw.* G.
Lycæna Acmon *West-Hew.* G. W.
Lycæna Amyntula *Bd.* G. W.
Lycæna exilis *Bd.* Deming.
Lycæna marina *Reak.* G.
Thymelicus Hylax *Edw.* G.
Pamphila Zabulon *Bd.-Lec.* G.
Pamphila Snowi *Edw.* G.
Pamphila Comma var. Juba *Scud.* G.
Pamphila Comma n. var. G.
Pamphila Cernes *Bd.-Lec.* G.
Pamphila Metacomet *Harr.* G.
Pamphila bimacula *Gr.-Rob.* G.
Pamphila Taxiles *Edw.* G.
Pamphila Phylace *Edw.* G.
Amblyscirtes æneus *Edw.* G.
Pyrgus tesselatta *Scud.* G.
Thanaos Martialis *Scud.* W.
Thanaos juvenalis *F.* G.
Thanaos funeralis *Scud.-B.* W.
Thanaos Pacuvius *Lintn.* G. W.
Pholisora catullus *Cram.* G. W.
Pholisora Pirus *Edw.* W.
Eudamus Pylades *Scud.* G.
Eudamus Bathyllus *Sm.-Abb.* G.

LEPIDOPTERA HETEROCERA (Moths).

SPHINGIDÆ.

Deilephila lineata *Fabr.* G.
Philampelus Achemon *Drury.* G.
Smerinthus geminatus *Say.* G.
Smerinthus occidentalis *Hy. Edw.* G.
Sphinx Celeus *Hubn.* G.
Sphinx Oreodaphne *Hy. Edw.* G.
Sphinx lugens *Walk.* G.

ZYGÆNIDÆ.

Alypiodes flavilinguis *Grote*, n. gen. and n. sp. G.
Ctenucha Cressoniana *Gr.* G.
Pygoctenucha funerea *Gr.*, n. gen. and n. sp. G.
Pygoctenucha Harrisii *Boisd.* G.
Harrisina Americana *Harr.* G.
Harrisina coracina *Clem.* G.
Triprocris Smithsonianus *Clem.* G.
Lycomorpha constans *Hy. Edw.* G.
Anatolmis Grotei *Pack.* G.

BOMBYCIDÆ.

Nola fuscula *Gr.* G.
Crocota brevicornis *Walk.* G.
Crocota ferruginosa *Walk.* G.
Crocota quinaria G. var. (?) G.
Callimorpha Lecontei *Boisd.* G.
Leucarctia acræa *Drury.* G.
Euchætes Oregonensis *Stretch.* G.
Halesidota ingens *Hy. Edw.* G.
Halesidota labecula *Gr.* n. sp. G. W.
Halesidota ambigua *Strk.* G.
Alexicles aspersa *Gr.* n. gen. and n. sp. G.
Nadata gibbosa A. and S. G.
Oedemasia perangulata *Hy. Edw.* G.
Telea Polyphemus var. oculea *Neum.* G.
Hyperchiria Io. *Fab.* var. G.
Hyperchiria Zephyria *Gr.* n. sp. G.
Pseudohazis Hera *Harr.* G.
Coloradia Pandora *Blake.* G.
Quadrina diazoma *Gr.* n. g. and n. sp. G.
Gloveria Arizonensis *Pack.* G. W.

NOCTUIDÆ.

Pseudothyatira cymatophoroides *Guen.* G.
Habrosyne scripta *Gosse.* G.
Acronycta albarufa *Gr.* G.
Acronycta thoracica *Gr.* G.
Acronycta noctivaga *Gr.* G.
Acronycta persuasa *Harv.* G.
Acronycta extricata *Gr.* G.
Agrotis conchis *Gr.* G.
Agrotis mirabilis *Gr.* G.
Agrotis agrestis *Gr.* var. G.
Agrotis tricosa *Lintner.* G.
Agrotis obeliscoides *Guen.* G.
Agrotis cupidissima *Gr.* G.
Agrotis brunneipennis *Gr.* G.
Agrotis variata *Gr.* G.
Agrotis orbis *Gr.* G.
Agrotis placida *Gr.* and var. G.
Agrotis Ridingsiana *Gr.* G.
Agrotis decolor *Morr.* G.
Agrotis albipennis *Gr.*
Agrotis atrifrons *Gr.* G.
Agrotis pastoralis *Gr.* G.
Agrotis fumalis *Gr.* G.
Agrotis munis *Gr.* G.
Agrotis malefida *Guen.* G.
Agrotis telifera *Harr.* G.
Agrotis saucia *Hubn.* G.
Agrotis caenis *Gr.* G.
Agrotis grandipennis *Gr.* n. sp. G.
Agrotis bimarginalis *Gr.* n. sp. G.
Agrotis circumdata *Gr.* n. sp. G.
Agrotis beata *Gr.* n. sp. G.
Agrotis terrealis *Gr.* n. sp. G.
Agrotis invenusta *Gr.* n. sp. G.
Agrotis near baja. n. sp. G.
Agrotis, four undetermined species, probably new. G.
Ammoconia chortalis *Harv.* G.
Ammoconia parentalis *Gr.* G.
Ammoconia decipiens *Gr.* G.
Ammoconia distichoides *Gr.* n. sp. G.
Mamestra discalis *Gr.* G.
Mamestra lilacina *Harv.* G.
Mamestra subjuncta *G.* and *R.* G.
Mamestra trifolii *Rott.* G.
Mamestra acutipennis *Gr.* G.
Mamestra detracta *Walk.* G.
Mamestra olivacea *Morr.* G.
Mamestra vittula *Gr.* n. sp. G.
Mamestra near Nevadæ n. sp. G.
Mamestra mimula *Gr.* n. sp. G.
Mamestra gnata *Gr.* (?) G.
Copimamestra occidenta *Gr.* n. gen. and n. sp. G.
Hadena devastatrix *Brace.* G.

Hadena arctica *Boisd.* G.
Hadena dubitans *Walk.* G.
Hadena auranticolor *Gr.* G.
Hadena auranticolor dark var. G.
Hadena perpensa *Gr.* G.
Hadena longula *Gr.* G.
Hadena fractilinea *Gr.* and var. G.
Hadena hausta *Gr.* G.
Hadena three undet. sp.
Pseudanarta flavidens *Gr.* G.
Oligia arna *Guen.* G.
Perigæa albolabes *Gr.* G.
Perigæa loculosa *Gr.* G.
Homohadena epipaschia *Gr.* n. sp. G.
Polia illepida *Gr.* G.
Polia Theodori *Gr.* G.
Tricholita semiaperta *Morr.* G.
Leucania bicolorata *Gr.* and var. G.
Leucania albilinea *Hubn.* G.
Leucania phragmitidicola *Guen.* G.
Leucania commoides *Guen.* G.
Leucania unipuncta *Haw.* G. W.
Caradrina meralis *Morr.*
Tæniocampa agrotiformis *Gr.* G.
Tæniocampa thecata *Morr.* G.
Tæniocampa three undet. sp. G.
Orthosia near disticha *Morr.* G.
Trichorthosia parallela *Gr.* n. gen. and n. sp. G.
Scoliopterix libatrix *Linn.* G.
Lithophane signata *Walk.* G.
Cucullia Speyeri *Lintn.* G.
Adipsophanes miscellus *Gr.*
Ingura prepilata *Gr.* G.
Basilodes chrysopis *Gr.* G. W.
Deva purpurigera *Walk.* G.
Plusia simplex *Guen.* G.
Tricopis chrysellus *Gr.* W.
Euleucyptera cumatilis *Gr.* W.
Grotella Dis. *Gr.* n. sp. G.
Bessula luxa *Gr.* n. sp. W.
Rhododipsa miniana *Gr.* n. sp. W.
Rhodosea Julia *Gr.* gen. and n. sp. G.
Heliothis phlogophagus *G.* and *R.* G.
Heliothis var. luteitinctus *Gr.* G.
Heliothis lucens *Morr.* G.
Lygranthœcia balba *Gr.* W.
Anthœcia brevis *Gr.* W.
Anthœcia Spraguei *Gr.* W.
Tarache angustipennis *Gr.* W.
Tarache sutrix *Gr.* W.
Drasteria erecthea *Cram.* var. G.
Euclidia intercalaris *Gr.* n. sp. G. W.
Litocala sexsignata *Harv.* G.
Cirrhobolina Mexicana *Behr.* G.
Catocala perdita *Hy. Edw.* G.
Catocala Walshii *Edw.* G.
Catocala Aspasia *Strk.* G.
Catocala Grotiana *Bailey.* G.
Catocala pura *Hulst.* G.
Catocala Hermia *Hy. Edw.* (?) G.
Catocala violenta *Hy. Edw.* G.
Catocala aholibah *Strk.* G.
Catocala Frederici *Gr.* G.
Toxocampa Victoria *Gr.* G.
Celiptera bucetum *Gr.* G.
Pseudanthracia coracias *Guen.* G.
Homopyralis discalis *Gr.* G.
Homopyralis miserulata *Gr.* n. sp. G.
Spargaloma sexpunctata *Gr.* G.
Pseudaglossa lubricalis *Gey.* G.
Epizeuxis æmula *Hubn.* G.
Epizeuxis Americalis *Guen.* and var. G.
Zanclognatha cruralis *Guen.* G.
Renia Belfragei *Gr.* var. G.
Renia undet. sp. G.
Bleptina caradrinalis *Guen.* G.

GEOMETRIDÆ.

Chœrodes catenulata *Gr.* n. sp. G.
Tetracis simplicaria *Gr.* n. sp. G.
Tetracis vidularia *Gr.* G.
Caberodes majoraria *Guen.* G.
Ennomos alniaria *Linn.* G.
Endropia madusaria *Walk.* G.
Ellopia vitraria *Gr.* n. sp. G.
Metrocampa margaritata *Linn.* G.
Lychnosea aulularia *Gr.* n. gen. and n. sp. G.
Sicya two n. sp. G.
Acidalia peralbata *Pack.* G.
Acidalia undet. sp. G.
Deilinia erythemaria *Guen.* G.
Deilinia undet. sp. G.
Semiothisa Californiata *Pack.* G.
Phasiane trifasciata *Pack.* W.
Phasiane cruciata *Gr.* n. sp. G.
Marmopteryx sponsata *Gr.* n. sp. G.
Thamnonoma perpallidaria *Gr.* n. sp. G.
Caripeta equaliara *Gr.* n. sp. G.
Fidonia alternaria *Gr.* n. sp. G.
Aspilates viridirufaria *Neum.* G.
Cymatophora humaria *Guen.* G.
Tephrosia three undet. sp. G.

Amphidasys Mexicanaria *Gr.* n. sp. G.
Phigalia lixaria *Gr.* n. sp. G.
Baptria albovittata *Guen.* G.
Lobophora inequaliata *Pack.* G.
Hydria undulata *Linn.* G.
Phibalapteryx intestinata *Guen.* G.
Phibalapteryx munitaria. G.
Petrophora prunata *Linn.* G.
Petrophora undet. sp. G.
Glaucopteryx cumatilis *G. and R.* G.
Eupithecia cretaceata *Pack.* G.
Emplocia cephisaria *Gr.* n. sp. W.
Emplocia fervefactaria *Gr.* n. sp. G. W.

PYRALIDÆ.

Parædis obliqualis *Gr.* n. sp. G.
Asopia olinalis *Guen.* G.
Asopia cohortalis *Gr.* G.
Asopia planalis *Gr.* G.
Emprepes novalis *Gr.* G.
Botis volupialis *Gr.* W.
Botis flavofascialis *Gr.* n. sp. W.
Botis tatalis *Gr.* W.
Botis allectalis *Gr.* W.
Botis mustelinalis *Pack.* G.
Botis socialis *Gr.* W.
Botis magniferalis *Walk.* W.
Botis fracturalis *Zell.* W.
Botis n. sp. W.
Eurycreon cereralis *Zell.* G.
Blepharomastix ranalis *Guen.* G.
Chryseudeton avernalis *Gr.* n. sp. G.
Nephopteryx auranticella *Gr.* n. sp. G.
Crambus dimidiatellus *Gr.* n. sp. G.

TORTRICIDÆ AND TINEIDÆ.

Cacœcia sp. G.
Tortrix sp. G.
Tinea sp. G.
Grapholitha sp. G.
Psecadia subcærulea *Wlsm.* G.

PTEROPHORIDÆ.

One undetermined species. G.

SUMMARY OF SPECIES OF LEPIDOPTERA

(Not including varieties).

RHOPALOCERA (butterflies)	80
HETEROCERA (moths):	
Sphingidæ	7
Zygænidæ	9
Bombycidæ	20
Noctuidæ	134
Geometridæ	40
Pyralidæ	19
Tortricidæ	5
Pterophoridæ	1
Total number of species	315
Number of new species	53

LIST OF COLEOPTERA.

CICINDELIDÆ.

10. Cicindela obsoleta *Say.* G.
10a. Cicindela vulturina *Lec.* G.
10b. Cicindela prasina *Lec.* G.
14. Cicindela pulchra *Say.* G. S.
15. Cicindela scutellaris *Say.* blk. var. S.
15c. Cicindela unicolir *Dej.* S.
22. Cicindela Audubonii blk. var. and green var. G.
22d. Cicindela cimarrona *Lec.* G. S.
28. Cicindela vulgaris *Say.* var. G.
30a. Cicindela Oregona *Lec.*
33. Cicindela hirticollis *Say.* S.
45. Cicindela macra *Lec.* S.
51. Cicindela punctulata *Fab.* G. S.
51a. Cicindela micans *Fab.* G. S.
55. Cicindela 16-punctata *Kb.* G.
61. Cicindela pretextata *Lec.* S.

Cicindelidæ: 11 species, 6 var.

CARABIDÆ.

105. Notiophilus Hardyi *Putz.* G.
134. Calosoma scrutator *Fab.* G.
139. Calosoma carbonatum *Lec.* G. W.
140. Calosoma triste *Lec.* W.
141. Calosoma obsoletum *Say.* G.
160. Carabus tædatus *Fab.* G.
178. Cychrus elevatus *Fab.* G.
200. Pasimachus elongatus *Lec.* G.

207a. Pasimachus costifer *Lec.* W.
343. Lebia majuscula *Chd.* G.
349. Lebia viridis *Say.* G.
360. Dianchomena scapularis *Def.* G.
364. Aphelogenia fuscata *Lec.* G.
366. Aphelogenia bivittata *Fab.* G.
393. Glycia viridicollis *Lec.* G.
397. Cymindis laticollis *Say.* G.
399. Cymindis abstrusa *Lec.* G.
436. Calathus dubia *Lec.* G.
461. Platynus extensicollis *Say.* G.
514. Platynus placidus *Say.* G. W.
—. Platynus nivalis *Horn.* W.
—. Evarthrus torvus *Lec.* G.
561. Evarthrus substriatus *Lec.*
638. Pterostichus Luczotii *Def.* G.
701. Amara confusa *Lec.* G. W.
—. Amara remota *Lec.* G.
705. Amara lævipennis *Kirby.* G.
706. Amara interstitialis *Dej.* and var. G.
722. Amara harpalina *Lec.* W.
819. Piosoma setosum *Lec.* W.
916. Selenophorus pedicularius *Dej.* G.
925. Harpalus retractus *Lec.* G.
926. Harpalus amputatus *Say.* G. W.
928. Harpalus caliginosus *Fabr.* G.
938. Harpalus fallax *Lec.* G.
940. Harpalus herbivagus *Say.* G.
950. Harpalus montanus *Lec.* G.
955. Harpalus funestus *Lec.* G. W.
956. Harpalus oblitus *Lec.* W.
959. Harpalus ochropus *Kirby.* G. W.
961. Harpalus basilaris *Kirby.* W.
—. Harpalus not named. W.
1059. Bembidium transversale *Dej.* G.
1062. Bembidium lugubre *Lec.* G.
1063. Bembidium striola *Lec.* G.
1067. Bembidium lucidum *Lec.* G.
1077. Bembidium nitens *Lec.* G.
—. Bembidium n. sp. G.
1143. Tachys nanus *Gyll.* G.

Carabidæ, 49 species, 1 var.

DYTISCIDÆ.

1210. Hydroporus nubilus *Lec.* G.
1229. Hydroporus striatellus *Lec.* G. W.
1261. Hydroporus vilis *Lec.* G.
1281. Laccophilus decipiens *Lec.* G.
1317. Rhantus binotatus *Harr.* G.
—. Ilybius Laramæus *Lec.* G.
1335. Ilybius biguttalus *Germ.* G. W.
1342. Ilybiosoma regularis *Lec.* G.
1381. Anisomera cordata *Lec.* G.

Dytiscidæ, 9 species.

HYDROPHILIDÆ.

1449. Hydrophilus triangularis *Say.* G.
1450. Tropisternus nimbatus *Say.* G.
1453. Tropisternus Californicus *Lec.* W.
1457. Tropisternus ellipticus *Lec.* W.
1476. Berosus infuscatus *Lec.* G.
1482. Limnocharis piceus *Horn.* G.
1497. Philhydrus diffusus *Lec.* G.
1513. Hydrobius rufiventris *Horn.* G.
1514. Hydrobius infuscatus *Mots.* G.

Hydrophilidæ, 9 species.

STAPHYLINIDÆ.

—. Homalota, two species. G.
1662. Aleochara bimaculata *Grav.* G.
1666. Aleochara nitida *Grav.* G.
1771. Creophilus villosus *Grav.* G. W.
1787 Staphylinus cinnamopterus *Grav.* G.
—. Philonthus sordidus *Fauv.* Ms. W.
—. Philonthus two undet. sp. G. W.
1804. Philonthus Californicus *Mann.* G.
1829. Philonthus picipennis *Maklin.* G.
—. Stenus two undet. sp. G.
1988. Platystethus Americanus *Er.* G.
7841. Geodromicus ovipennis *Lec.* G.

Staphylinidæ, 15 species.

SILPHIDÆ.

2176. Necrophorus marginatus *Fab.* G. W.
2178a. Necrophorus Hecate *Bland.* G.
2188. Silpha lapponica *Hb.* G. W.
2194. Silpha truncata *Say.* G.
7943. Anisotoma valida *Horn.* G.

Silphidæ, 5 species.

LATRIDIIDÆ.

—. Corticaria undet. sp. G.

Latridiidæ, 1 species.

DERMESTIDÆ.

2393. Dermestes marmoratus *Say.* G. W.
2395. Dermestes nubilus *Say.* W.
2396. Dermestes talpinus *Mann.* G.
2404. Dermestes maculatus *Deg.* W.
2422. Cryptorhopalum apicale *Mann.*
2430. Anthrenus varius *Fab.* G.
2434a. Orphilus subnitidus *Lec.* G.

Dermestidæ, 7 species.

ENDOMYCHIDÆ.

2441. Mycetina morosa *Lec.* G.
2449. Epipochus unicolor *Horn.* G.

Endomychidæ, 2 species.

EROTYLIDÆ.

2514. Languria gracilis *Neum.* W.
2541. Cypherotylus Boisduvali *Chev.* G. W.

Erotylidæ, 2 species.

TROGOSITIDÆ.

2682. Trogosita virescens *Fab.* G.
2688. Tenebrioides corticalis *Mels.* G.

Trogositidæ, 2 species.

NITIDULIDÆ.

2729. Carpophilus pallipennis *Say.*
2730. Carpophilus mutilatus *Fab.* G.
2738. Epurœa infuscata *Maklin.* G.
2739. Epurœa æstiva *Linn.*
2752. Epurœa rufa *Say.* G.
2755. Nitidula zizzac *Say.* G.
2757. Soronia undulata *Say.* G.
2767. Meligethes ruficornis *Lec.* G.
2772. Perthalycra Murrayi *Cr.* G.
2794. Pityophagus cephalotes *Lec.* W.

Nitidulidæ, 10 species.

PHALACRIDÆ.

2805. Phalacrus penicillatus *Say.* G.
2809. Olibrus vittatus *Leq.* G.
—. Olibrus, two undetermined sp. G.

Phalacridæ, 4 species.

COCCINELLIDÆ.

8060. Epilachna corrupta *Muls.* G. W.
2827. Hippodamia 5-signata *Kirby.* W.
2829. Hippodamia Le Contei *Muls.* G.
2832. Hippodamia convergens *Guer.* G. W.
2837. Hippodamia parenthesis *Say.* G.
2847. Coccinella 9-notata *Hb.* G.
2848. Coccinella 5-notata *Kirby.* G.
2849. Coccinella monticola *Muls.*
2853. Cycloneda sanguinea *Linn.* G.
2854*a*. Cycloneda abdominalis *Say.* G. W.
2858. Harmonia picta *Rand.* G.
2863. Anatis Rathvoni *Lec.* var. G.
2864. Anatis subvitatta *Muls.* G.
2867. Psyllobora 20-maculata *Say.* G.
2871. Exochomus Pilatii *Muls.* G.
2872*a*. Exochomus æthiops *Bland.* G.
2877*a*. Brachyacantha 10-pustulata *Mels.* G.
2882. Hyperaspis fimbriolata *Mels.* G.
2919. Scymnus collaris *Mels.* G.

Coccinellidæ, 19 species.

PARNIDÆ.

2977. Helichus striatus *Lec.* G.

Parnidæ, 1 species.

HISTERIDÆ.

3031. Hister instratus *Lec.* G.
3049. Hister abbreviatus *Fab.* G.
3053. Hister depurator *Say.* G.
3093. Epierus nasutus *Horn.* G.
3131. Saprinus lugens *Er.* G.
3133. Saprinus Pennsylvanicus *Payk.* W.
3134. Saprinus Oregonensis *Lec.* G.
3153. Saprinus neglectus *Mars.* G. W.
3158. Saprinus fimbriatus *Lec.* G.

Histeridæ, 9 species.

LUCANIDÆ.

3205. Lucanus mazama *Lec.* G. W.

Lucanidæ, 1 species.

SCARABÆIDÆ.

3219. Canthon praticola *Lec.* W.
3230. Canthon hudsonias *Forst.* G.
3241. Phanæus carnifex *Linn.* G. W.
——. Onthophagus coproides *Horn.* W.
3244. Onthophagus Hecate *Panz.* G.
3262. Aphodius ursinus *Mots.* G.
3263. Aphodius ruricola *Mels.* W.
3295. Aphodius Coloradensis *Horn.* G. W.
3187. Aphodius subtruncatus *Lec.* G.
——. Aphodius duplicatus. W.
3145. Atænius figurator *Har.* W.
3147. Ochodæus Ulkei *Horn.* G.
3351. Bolboceras farctus *Fab.* W.
3352. Bolboceras lazarus *Fab.* G. W.
3371. Trox scutellaris *Say.* W.
3377. Trox suberosus *Fab.* W.
3379. Trox punctatus *Germ.* W.
3381. Trox Sonoræ *Lec.* G. W.
3404. Hoplia laticollis *Lec.* G.
3420. Serica vespertina *Schon.* G.
——. Serica n. sp. G.
3165. Macrodactylus uniformis *Horn.* G. W.
3456. Diplotaxis brevicollis *Lec.* G. W.
3457. Diplotaxis obscura *Lec.* W.
3473. Diplotaxis carbonata *Lec.* W.
3504. Lachnosterna fusca *Frohl.* G.
3508. Lachnosterna micans *Lec* G.
3521. Lachnosterna affinis *Lec.* G.
3528. Lachnosterna hirsuta *Knoch.* G.
3560. Listrochelus falsus *Lec.* G.
3564. Tostegoptera lanceolata *Say.* G. W.
3569. Polyphylla 10-lineata *Say.* G.
3591. Plusiotis gloriosa *Lec.* W.
——. Plusiotis Lacordairei *Lec.* W.
3597. Cyclocephala immaculata *Burm.* W.
3609. Ligyrus gibbosus *De Geer.* W.
3614. Aphonus pyriformis *Lec.* G.
3626. Strategus cessus *Lec.* W.
3684. Allorhina nitida *Linn.* W.
3645. Euphoria Kernii *Hald.* G. W.
3646. Euphoria inda *Linn.* G. W.
3650. Euphoria fulgida *Fab.* G.
3672. Trichius affinis *Gory.* G.

Scarabæidæ, 43 species.

BUPRESTIDÆ.

3682. Chalcophora angulicollis *Lec.* G.
3688*a*. Psiloptera Webbii *Lec.* W.
3689. Dicerca prolongata *Lec.* G.
3701. Dicerca sexualis *Gr.* G.
3707. Pœcilonota cyanipes *Say.* G.
3715. Buprestis consularis *Gory.* G.
3716. Buprestis Nuttalli *Kirby.* G. W.
3718. Buprestis maculiventris *Say.* G.
3719*a*. Buprestis Langii *Mann.* G.
3722. Buprestis lauta *Lec.* G.
3723. Buprestis adjecta *Lec.* G.
3732. Melanophila longipes *Say.* G.
3734. Melanophila Drummondi *Kirby* and var. G.
3736. Melanophila gentilis *G. and H.* G.
3738. Anthaxia inornata *Rand.* G.
3743. Anthaxia flavimana *Gory.* G.
3751. Chrysobothris 4-lineata *Lec.* G. W.
3753. Chrysobothris dentipes *Germ.* G.
3756. Chrysobothris trinervia *Kirby.* G.
3769. Chrysobothris æneola *Lec.*
3782. Acmæodera amplicollis *Lec.* W.
3790. Acmæodera ornata *Fab.* W.
3791. Acmæodera pulchella *Hbst.* G.
3794. Acmæodera pulchella *Horn.* G.
3224. Chrysophana placida *Lec.* G.
3816. Agrilus interruptus *Lec.* G.
3825. Agrilus politus *Say.* G.
3828. Agrilus egenus *Gory.* G.
3841. Brachys ærosa *Mels.* G.
3844. Pachyscelus purpureus *Say.* G.

Buprestidæ, 30 species.

ELATERIDÆ.

3866. Deltometopus amœnicornis *Say.* G.
3902. Anelastes Drurii *Kirby.* G.
3918. Adelocera rorulenta *Lec.* G.
3935. Alaus melanops *Lec.* G.
——. Elater n. sp. G.
4125. Glyphonyx recticollis *Say.* W.
4149. Melanotus fissilis *Say.* G.
4151. Melanotus exuberans *Lec.* G.
3258. Athous cribratus *Lec.* G.
4326. Corymbites inflatus *Say.* G.
4332. Asaphes carbonatus *Lec.* G.

4337. Asaphes memnonius *Hbst.* G.
Elateridæ, 12 species.

LAMPYRIDÆ.

8291. Dictyoptera rubripennis *Lec.* G.
8293. Dictyoptera ruficollis *Lec.* G.
4427. Cænia sanguinipennis *Say.* G.
——. Cænia amplicollis *Lec.* G.
——. Lycostomus fulvellus *Lec.* G.
4439. Eros modestus *Say.* G.
4443. Eros canaliculatus *Say* var. G.
4449*a*. Photinus Californicus *Mots.* G.
4450. Photinus corruscus *Linn.* G.
4451. Photinus flavicollis *Lec.*
4454. Photinus decipiens *Harr.* W.
Lampyridæ, 11 species.

TELEPHORIDÆ.

4482. Chauliognathus scutellaris *Lec.* G. W.
8304. Chauliognathus Lewisii *Cr.* W.
4507. Podabrus piniphilus *Esch.* G.
4523. Telephorus rectus *Mels.* G.
4526. Telephorus flavipes *Lec.* G.
4547. Telephorus collaris *Lec.* G.
Telephoridæ, 6 species.

MALACHIDÆ.

4577. Collops punctatus *Lec.* W.
4578. Collops eximius *Er.* G.
4582. Collops bi-punctatus *Say.* G. W.
4595. Trophimus æneipennis *Horn.* G.
4624. Attalus basalis *Lec.* G.
4689. Attalus difficilis *Lec.* G.
4673. Pristoscelis rufipennis *Lec.* W.
——. Pristoscelis comatus *Lec.* G.
4683. Listrus senilis *Lec.* G.
Malachidæ, 9 species.

CLERIDÆ.

4716. Trichodes ornatus *Say.* G.
4716*a*. Trichodes tenellus *Lec.* G.
4721. Aulicus Nero *Spin.* W.
——. Clerus atriventris *Lec.* G.
4724. Clerus analis *Lec.* W.
4734. Clerus cordifer *Lec.* G.
4736. Clerus nigriventris *Lec.* G.
4737. Clerus sphegeus *Fabr.* G.
4746. Clerus undulatus *Say.* G.
4753. Hydnocera subænea *Spin.* G.
4756. Hydnocera pubescens *Lec.* G.
4789. Corynetes rufipes *Fab.* W.
4791. Corynetes violaceus *Linn.* G.
Cleridæ, 12 species, 1 var.

PTINIDÆ.

——. Ernobius n. sp. G.
Ptinidæ, 1 species.

CERAMBYCIDÆ.

4907. Ergates spiculatus *Lec.* G.
4914. Derobrachus geminatus *Lec.* W.
4918. Prionus Californicus *Motsch.* G. W.
4923. Homæsthesis emarginatus *Say.* G.
4924. Trogosoma Harrisii *Lec.* G.
4931. Criocephalus productus *Lec.* G.
4938. Tetropium velutinum *Lec.* G.
4964. Callidium hirtellum *Lec.* G.
5051. Rhopalophora longipes *Say.* G.
——. Pteroplatus n. sp. G.
5066. Stenaspis solitaria *Say.* Deming.
5067. Tragidion annulatum *Lec.* G.
5068*a*. Tragidion fulvipenne *Say.* G. W.
5077. Batyle ignicollis *Say.* G. W.
5081. Batyle Pearsalli *Bland.* G.
6085. Tylosis maculata *Lec.* S.
5090. Crossidius intermedius *Ulke.* S.
5091. Crossidius pulchellus *Lec.* G. W.
5094. Crossidius discoideus *Say.* S.
5095. Sphaenothecus suturalis *Lec.* Deming.
5104. Cyllene infaustus *Lec.* G.
5108. Cyllene lutosus *Lec.* W.
5111. Calloides nobilis *Say.* G.
5117. Xylotrechus sagittatus *Germ.* G.
5120. Xylotrechus undulatus *Say.* and var. G.
5198. Acmæops longicornis *Kirby.* G.
5205. Acmæops pratensis *Laich.* G.
5217. Strangalia 6-notata *Hald.* G.
5219. Typocerus zebratus *Fab.* G.
5221. Typocerus velutinus *Oliv.* G.
5223. Typocerus brunnicornis *Lec.* G.
5224. Typocerus sinuatus *Newm.* G.
5264. Leptura nigrella *Say.* var. G.
5265. Leptura carbonata *Lec.* G.
5266*b*. Leptura cribripennis *Lec.* G.
5272. Leptura sanguinea *Lec.* G.
5276. Leptura chrysocoma *Kirby.* G.
5297. Leptura mutabilis *Newm.* G.
5306. Monilema annulatum *Say.* G.
5312. Monilema lævigatum *Bland.* S.
5313. Monilema crassum *Lec.* G.
5321. Monohammus maculosus *Hald.* G.
5323. Monohammus scutellatus *Say.* G.
5371. Hyperplatys maculatus *Hald.* G.
5377. Acanthocinus obliquus *Lec.* G.
5378. Acanthocinus spectabilis *Lec.* G.
5381. Dectes spinosus *Say.* G. W.
5388. Pogonocherus mixtus *Hald.* G.
5425. Mecas pergrata *Say.* G.
5443. Tetraopes discoideus *Lec.* G.
5448. Tetraopes femoratus *Lec.* G.
5449. Tetraopes basalis *Lec.* G.
5551. Tetraopes canescens *Lec.* G. S.
Cerambycidæ, 53 species.

SPERMOPHAGIDÆ.

5483. Bruchus aureolus *Horn.* G.
5485. Bruchus prosopis *Lec.* S.
Spermophagidæ, 2 species.

CHRYSOMELIDÆ.

5535. Orsodachna Childreni *Kirby.* G.
5541. Zeugophora consanguinea *Cr.* G.
5554. Lema trilineata *Oliv.* G.
——. Lema trilineata form trivirgata *Lec.* G.
——. Lema. n. sp. G.
5561. Babia 4-guttata *Oliv.* G.
5562. Urodera crucifera *Lac.* G.
5611. Cryptocephalus 4-guttulus *Suffr.* G.
5614. Cryptocephalus auratus *Fab.* G.
5627. Pachybrachys pubescens *Oliv.* G.
5642. Pachybrachys atomarius *Mels.* G.
5648. Pachybrachys tridens *Mels.* G.

5661. Pachybrachys litigiosus *Suffr.* G.
5664. Pachybrachys hepaticus *Mels.* G.
——. Pachybrachys, 2 n. sp. G.
8512. Pachybrachys dubiosus *Lec.* G.
5668. Xanthonia 10-notata *Say.* G.
5688. Chrysochus auratus *Fab.* G.
5695. Paria aterrima *Oliv.* ♀.
5728. Chrysomela rubiginosa *Rog.* W.
5729. Chrysomela exclamationis *Fab.* G.
5730. Chrysomela conjuncta *Rog.* G.
5782. Chrysomela suturalis *Fab.* G.
5741. Chrysomela multipunctata *Say.* G.
5750. Chrysomela auripennis *Say.* G. W.
——. Chrysomela. n. sp. G.
5773. Plagiodera viridis *Mels.* G. W.
5792. Luperus Le Contei *Cr.* G.
5794. Luperus longulus *Lec.* G.
5800. Diabrotica tricincta *Say.* S.
5802. Diabrotica 12-punctata *Oliv.* S.
5809. Diabrotica longicornis *Say.* S.
5810. Diabrotica lemniscata *Lec.* S.
5811. Diabrotica atripennis *Say.* G.
5814. Galeruca externa *Say.* G.
5815. Galeruca Americana *Fab.* G.
5820. Galerucella tuberculata *Say.* G.
5831. Monoxia guttulata *Lec.* G.
5834b. Trirhabda Canadensis *Kirby.* G.
5860. Oedionychis Texana *Cr.* G.
5865. Disonycha alternata *Ill.* S.
5873. Disonycha triangularis *Say.* G.
5874. Disonycha collaris *Fab.* G.
5877. Graptodera carinata *Germ.* G.
5887. Graptodera punctipennis *Lec.* and var. G.
——. Graptodera, not named. S.
——. Graptodera, n. sp. G.
——. Graptodera, 2 undet. sp, G.
——. Longitarsus, 3 species. G.
5899. Glyptina spuria *Lec.* G.
——. Glyptina, n. sp. G.
5907. Orchestris albionica *Lec.* G.
5920. Systena oblonga *Lec.* G.
5921. Systena blanda *Mels.* G.
5933. Epitrix cucumeris *Harr.* G.
5941. Chaetocnema subviridis *Lec.* G.
5943. Chaetocnema crenulata *Cr.* G.
5862a. Odontota inæqualis *Web.* G.
5980. Cassida nigripes *Oliv.* G.
5985. Coptocyla aurichalcea *Fab.* G.

Chrysomelidæ, 63 species, 1 var.

TENEBRIONIDÆ.

6010. Epitragus canaliculatus *Say.* G.
——. Eurymetopon n. sp. G.
6029. Emmenastus acutus *Horn.* G. W.
6068. Asida opaca *Say.* G. W.
6070. Asida polita *Say.* G. W.
6071. Asida sordida *Lec.* and var. G. W.
6073. Asida morbillosa *Lec.* W.
6092. Asida convexa *Lec.* W.
6095. Asida marginata *Lec.* W.
6065a. Asida rimata *Lec.* W.
6097. Asida elata *Lec.* W.
——. Asida n. sp. W.
6100. Astrotus regularis *Horn.* W.
6105. Eusattus reticulatus *Say.* W.
6127. Eleodes obscura *Say.* G. W.
6127a. Eleodes dispersa *Lec.* G. W.
6129. Eleodes suturalis *Say.* W.
6129a. Eleodes Texana *Lec.* G.
6131. Eleodes tricostata *Say.* G.
6132. Eleodes carbonaria *Say.* W.
——. Eleodes carbonaria form debilis. W.
6133. Eleodes obsoleta *Say.* G. W.
6137. Eleodes extricata *Say.* G. W.
6141. Eleodes longicollis *Lec.* W.
6143. Eleodes ventricosa *Lec.* W.
6145. Eleodes gracilis *Lec.* W.
6152. Eleodes caudifera *Lec.* W.
6163. Eleodes planipennis *Lec.* W.
6202. Iphthimus serratus *Mann.* G.
6244. Blapstinus pratensis *Lec.* G.
6320. Platydema Oregonense *Lec.* G.
——. Ulus not named. W.

Tenebrionidæ, 28 species, 5 var.

ALLECULIDÆ.

——. Allecula n. sp. G.
6375. Hymenorus obscurus *Say.* G.
6385. Pseudocistela pinguis *Lec.* G.

Alleculidæ, 3 species.

LAGRIIDÆ.

——. Statira n. sp. G.

Lagriidæ, 1 species.

ANTHICIDÆ.

——. Notoxus n. sp. G.
6526. Xylophilus piceus *Lec.* G.

Anthicidæ, 2 species.

MORDELLIDÆ.

6579. Anaspis atra *Lec.* G.
6583. Anaspis rufa *Say.* G.
6585. Anaspis pusio *Lec.* G.
6594. Mordella scutellaris *Fab.* G.
6603. Mordella insulata *Lec.* G.
6672. Emmenadia pectinata *Fab.* G.

Mordellidæ, 6 species.

MELOIDÆ.

6701. Meloe sublævis *Lec.* G. S.
6705. Megetra cancellata *Er.* S.
6709. Cysteodemus Wislizenii *Lec.* S.
6719. Macrobasis unicolor *Kirby.* G.
6726. Pleuropompha costata *Lec.* Deming.
6731. Epicauta ferruginea *Say.* G. S.
6732. Epicauta sericans *Lec.* G.
6746. Epicauta corvina *Lec.* S.
6750. Pyrota mylabrina *Chev.* S.
6777. Cantharis biguttata *Lec.* G. S.
8700. Cantharis mutilata *Horn.* S.
6799. Eupompha fissiceps *Lec.* S.
6805. Zonitis bilineata *Say.* G.
8703. Zonitis rufa *Lec.* G.
6807. Nemognatha sparsa *Lec.* S.
6808. Nemognatha bicolor *Lec.* G.
6811. Nemognatha pallens *Lec.* G.
6821. Nemognatha nigripennis *Lec.* G.
6824. Nemognatha cribraria *Lec.* G.
6825. Nemognatha immaculata *Say.* G.
6828. Nemognatha porosa *Lec.* G. S.

Meloidæ, 21 species.

MELANDRYIDÆ.

8669. Tetratoma concolor *Lec.* G.
Melandryidæ, 1 species.

ŒDEMERIDÆ.

6841. Ditylus obscurus *Lec.* G.
——. Oxacis not described.
Œdemeridæ, 2 species.

MYCTERIDÆ.

6866. Mycterus concolor *Lec* and var. G.
8712. Lacconotus pinicolus *Horn.* G.
Mycteridæ, 2 species, 1 var.

PYTHIDÆ.

6874. Crymodes discicollis *Lec.* G.
6880. Salpingus virescens *Lec.* G.
Pythidæ, 2 species.

RHYNCHITIDÆ.

8727. Rhynchites bicolor *Fabr.* G.
8729. Rhynchites æneus *Boh.* G.
Rhynchitidæ, 2 species.

BYRSOPIDÆ.

8748. Thecesternus humeralis *Say.* G. S.
——. Thecesternus not determined. G.
Byrsopidæ, 2 species.

OTIORHYNCHIDÆ.

8761. Ophryastes vittatus *Say.* S.
8780. Anametis grisea *Lec.* G.
8785. Peritaxia rugicollis *Horn.*
8813. Thricolepis inornata *Horn.* G.
8833. Pandeleteius hilaris *Hbst.* G.
8836. Cyphus lautus *Lec.* Deming.
8842. Phacepholis elegans *Horn.* G.
Otiorhynchidæ, 7 species.

CURCULIONIDÆ.

8867. Sitones tibialis *Hbst.* G.
8879. Lepidophorus lineaticollis *Kirby.* G.
8883. Phytonomus setigerus *Lec.* G.
8950. Cleonus frontalis *Lec.* G.
8956. Cleonus vittatus *Kb.* G.
—— Dorytomus not named. G.
9002. Desmoris constrictus *Say.* G.
9014. Smicronyx fulvus *Lec.* G.
9067. Magdalis cuneiformis *Horn.* G.
9068. Magdalis Lecontei *Horn.* G.
9096. Anthonomus rufipennis *Lec.* G.
9106. Anthonomus squamosus. *Lec.* G.
9130. Orchestes niger *Horn.* G.
9163. Laemosaccus plagiatus *Fab.* G.
9194. Rhyssematus lineaticollis *Say.* G.
9209. Acalles turbidus *Lec.* S.
9248. Zascelis irrorata *Lec.* G.
9254. Copturus operculatus *Say.* G.
9306. Orthoris crotchii *Lec.* G.
9316. Baris strenua *Lec.* G.
9336. Onychobaris cribrata *Lec.* G.
9368. Centrinus neglectus *Lec.* G.
9407. Balaninus nasicus *Say.* W.
Curculionidæ, 23 species.

CALANDRIDÆ.

9467. Cossonus concinnus *Boh.* G.
Calandridæ, 1 species.

SCOLYTIDÆ.

9500. Pityophthorus retusus *Lec.* G.
9536. Xyloterus scabricollis *Lec.* G.
9565. Tomicus plastographus *Lec.* G.
9567. Tomicus rectus *Lec.* G.
9589. Scolytus Californicus *Lec.* G.
9619. Dendroctonus terebrans *Oliv.* G.
9620. Dendroctonus similis *Lec* var. G.
9633. Hylastes longus *Lec.* G.
—— Hylastes n. sp. G.
9643. Hylurgops rugipennis *Mannh.* G.
Scolytidæ, 10 species.

ANTHRIBIDÆ.

9653. Allandrus bifasciatus *Lec.* G.
Anthribidæ, 1 species.

APIONIDÆ.

—— Two undetermined species. G.
Apionidæ, 2 species.

SUMMARY OF SPECIES OF COLEOPTERA.

Cicindelidæ	11	Buprestidæ	30
Carabidæ	49	Elateridæ	12
Dytiscidæ	9	Lampyridæ	11
Hydrophilidæ	9	Telephoridæ	6
Staphylinidæ	15	Malachidæ	9
Silphidæ	5	Cleridæ	12
Latridiidæ	1	Ptinidæ	1
Dermestidæ	7	Cerambycidæ	53
Endomychidæ	2	Spermophagidæ	2
Erotylidæ	2	Chrysomelidæ	63
Trogositidæ	2	Tenebrionidæ	23
Nitidulidæ	10	Alleculidæ	3
Phalacridæ	4	Lagriidæ	1
Coccinellidæ	19	Anthicidæ	2
Parnidæ	1	Mordellidæ	6
Histeridæ	9	Meloidæ	21
Lucanidæ	1	Melandridæ	1
Scarabæidæ	43	Œdemeridæ	2

Mycteridæ	2	Apionidæ	2
Pythidæ	2		
Rhynchitidæ	2	Total: Families, 46; species (not including varieties)	514
Byrsopidæ	2	No. of new species	17
Otiorhynchidæ	7	Total No. species Lepidoptera and Coleoptera	829
Curculionidæ	23	Total No. new species Lepidoptera and Coleoptera	70
Calandridæ	1		
Scolytidæ	10		
Anthribidæ	1		

ON THE MOTHS COLLECTED BY PROF. SNOW IN NEW MEXICO.

BY A. R. GROTE, PRESIDENT OF THE NEW YORK ENTOMOLOGICAL CLUB.

The collections made by Prof. Snow, in New Mexico, have turned out to be of great scientific interest. Not only have there been valuable and showy insects taken, such as *Hyperchiria Zephyria, Gloveria Arizonensis, Halesidota Ambigua* and *Aspilates Viridirufaria,* but a number of new species, interesting from their structure, have been captured, such as *Trichothosia Parallela.* Again, light has been thrown on the geographical distribution. We have not only Californian and Eastern forms meeting as on common ground, but new representative species have occurred in these remote latitudes, such as *Copimamestra Occidenta.* The discovery in southern Arizona of *Phægarista Sevorsa* Grote, a species allied to the East Indian *P. Transiens,* is very remarkable; and other just as interesting resemblances with Asiatic forms may be expected from this new field for entomological exploration. It must not be forgotten that my genus *Heliochilus* occurs only in India and the United States. So far as the moths are concerned, Prof. Snow has been the pioneer, and a worthier one could not be found.

The late Professor Agassiz, whose lectures were so charming from his learning, noble presence, and enthusiasm for natural history, held strongly for the distinctness of what are called "representative species." In the Moths, the near resemblance of some species, such as *Copimamestra Occidenta* and *Apatela Occidentalis,* with their European analogues, I have accounted for by the theory that they are descendants from a single member of a Tertiary circumpolar fauna. There is a parallel between vertical ascension and distribution towards the Pole, as Professor Agassiz has explained. This is shown by a comparison of the faunæ of Mount Washington and Labrador. I think I was the first to identify the Arctic *Laria Rossii,* from specimens taken by Mr. B. Pickman Mann on Mount Washington. I have also identified the *Agrotis Scropulana* and *A. Opipara,* of Mr. Morrison, described from Mount Washington, with the *Pachnobia Carnea* and *Agrotis Islandica* of Mr. Moeschler, from Labrador. After seeing Icelandic specimens, however, I doubt if the Labrador species is the same. Dr. Packard's "Islandica" from the West is

quite a different insect, viz., *Agrotis Auxiliaris*, which is very variable, exhibiting several distinct varieties or races, and being found at very great elevations and also at very different levels. It is larger and totally different from either *Islandica* or *Opipara*.

The new species collected by Prof. Snow near Las Vegas, New Mexico, are in part as follows:

ALYPIODES n. gen.

Wings much longer than in *Alypia*, and the body smoothly scaled and longer. Legs not pilose. Vein 5 further from 4 than 3 at base. This form already loses the essential feature of *Alypia*, the short, broad wings, and approaches the lower genera. *Mariposa* suggests the present type, and may be congeneric.

ALYPIODES FLAVILINGUIS n. s.

Female: Blue black. On the cell are two brilliant metallic-blue, narrow patches, the first ovate, the last lunate; base with blue marks submedially and on costa. Three pale yellow patches, subovate, increasing in size outwardly, alternate with the blue spots. A pale yellow, small discal spot on secondaries. Fringes touched with white at apices of both wings. Tongue bright yellow. Head black; orbits pale yellow; collar with two yellow spots. Legs black; body blue black. *Expanse* 48 mil. *Length of body* 18 mil. New Mexico. Prof. F. H. Snow.

PYGOCTENUCHA n. gen.

Wings entire, a little narrower than in *Ctenucha*. Eyes naked. Front smooth. Abdomen tufted; in the female provided with a thick tuft, like some Bombyces belonging to the Dasychiræ or the Noctuid genus *Arzama*. Labial palpi rather slender, a little exceeding the front. Male antennæ ciliate, sub-pectinate; of the female serrate, each projection furnished with a single terminal seta. *Type: Ctenucha Harrisii* Boisd.

PYGOCTENUCHA FUNEREA n. s.

Male: Body slender; wings entire. Entirely dull black, with a yellow spot on each side of the collar and a yellow anal tuft. *Expanse* 30 mil. No. 1036.

This cannot remain in *Ctenucha*, nor can the succeeding species. Only one fresh specimen; the species cannot be mistaken, from the simplicity of its markings.

PYGOCTENUCHA HARRISII Boisd.

One female with the scarlet anal tuft large and thick, pale fawn-color at extremity. This form, as remarked by Mr. Hulst in redescribing it, is intermediate between *Ctenucha* proper and *Scepsis*.

ALEXICLES n. g.

A genus of *Bombycidæ*, differing from any one of our United States forms by the hairy eyes, more produced head, etc. The thick clypeal vestiture conceals the small palpi. The abdomen is short. Male antennæ pectinate.

Wings rather long and narrow, entire, subdiaphanous. In placing it among the Arctians, I have probably not found its best place. Cell in primaries closed. Veins 3–5 arising near together.

ALEXICLES ASPERSA n. s.

Male: Blackish fuscous, concolorous, subtransparent. The veins in primaries curiously marked with fine white streaks. No other markings, except that at end of cell is a black cloud, and subterminally there are some vague darker spots. A scarlet rim behind the eyes; anal tuft slight, with central scarlet hairs above; legs inwardly somewhat reddish. *Expanse* 32 mil. No. 916. New Mexico.

TELEA POLYPHEMUS var. OCULEA *Neumoegen.*

This fine variety, described by Mr. Neumoegen from female specimens taken in Arizona, differs from the type form of the species by an inner blue line and black ring and cloud surrounding the ocelli on primaries, so that they resemble the ocelli on secondaries in appearance. Professor Snow's specimen has the black shading reduced to a black ring.

HYPERCHIRIA ZEPHYRIA Grote.

The male *Hyperchiria zephyria* expands 72 mil.; the thorax and fore wings are olive-blackish, and the white spots at insertion of primaries distinct. A white oblique stripe from apex to middle of internal margin. Hind wings with pink hair along inner margin; the disc vivid yellow, bounded by a rounded black line, and containing the large black ocellus with central white streak and some blue scales. Terminal field pale fuscous, with a darker clouded shade line. Abdomen all pink above. Beneath, the wings are discolorlous, pale fuscous, with a black, rounded spot on disc, with central white point, the latter repeated only on hind wings. Head dark; body and legs like hind wings beneath; antennæ, yellowish-testaceous pectinate. With its congener *H. pamina* and *Argyauges Neumoegeni*, this is one of the most notable additions to the catalogue of recent discoveries in the United States.

AGROTIS ATRIFRONS Grote.

This species may be known by the black mesial lines, the only marks on the brown shaded primaries, and by the black front; the s. t. line sometimes feebly marked in pale, also the median shade. No. 927. Professor Snow; New Mexico.

AGROTIS TERREALIS n. s.

Male and female: Very dark blackish-brown; allied to *Fennica* and *Turris.* Costa bright brown from base to middle. Stigmata moderate, concolorlous, set in a blackish shade. A submedian black streak at base, before the long black claviform. Lines obsolete; t. a. line marked inferiorly. Hind wings blackish fuscous, with interlined white-tipped fringes. Beneath unlined, fuscous, with discal mark on hind wings. *Expanse* 36 mil. No. 936.

AGROTIS INVENUSTA n. s.

Female: Allied to *Atrifrons*, with the same simple markings. Blackish-ashen; median lines single, black, indistinct, slightly relieved by pale shade, and emanating from costal dots. Only the two lines can be made out. Thorax blackish-ashen; front and tips of palpi gray. Hind wings dark fuscous, a litle paler on the disc, veins soiled, no lines, a discal lunule. Beneath a curved black exterior line, very distinct on costal region of primaries, repeated on secondaries, and followed here by a faint sub-marginal shade; the discal mark on hind wings repeated. *Expanse*, 35 mil. No. 942. This species, although obscure in appearance, should be readily identified by the simple markings, and its affinity with *Atrifrons*, even in the markings beneath, which are plainer than usual. The color is different — the front pale, the hind wings darker than its ally.

AMMOCONIA DISTICHOIDES n. s.

Eyes naked. Tibiæ armed. Thorax with a central ridge. Much resembles *Orthosia Disticha*, of an even, olivaceous gray. Sub-terminal line faint, single, dark, starting from a black trigonate spot on costa. T. p. line punctate. A black interrupted terminal line. Stigmata approximate concolorous, indistinct, with a reddish stain. Median shade visible below reniform, marked between them on cell, and again above reniform on costa. T. a line thrice waved, single, black, marked on costal region. Thorax and head like primaries. Under the glass the primaries are dotted with fine black speckles. Hind wings pale fuscous, unlined, with paler fringes. Beneath, a common exterior black line, marked on veins over costal region, else obliterate. Discal marks. Smaller than *Aratrix*, to which it is nearest allied. New Mexico. "940." Prof. Show. *Expanse* 35 mil.

MAMESTRA VITTULA n. s.

Female. Allied to the Californian *4-lineata*, the t. a. line not so oblique, and no reddish stain on fore wings; hind wings white, the veins very slightly soiled. Collar gray with blackish edge; thorax blackish gray. Primaries blackish gray. T. a. line scalloped. A black basal dash. Median space shaded with black. Stigmata small, concolorous dark gray. Terminal field paler gray, preceded by the s. t. line, which is irregular, shaded with black, especially at costa; a black dash at anal angle, before which the s. t. line is bent and heavily marked with black. Beneath no markings; hind wings white, dusted a little on costa; fore wings pale fuscous. No. 957. *Expanse* 24 mil.

MAMESTRA MIMULA n. s.

Male. Small-sized, a miniature of *Adjuncta*. Blackish, with an olive tinge to the ground color, recalling *Glaciata*. Reniform oval, yellowish white, prominent, with a central black mark. Orbicular a minute annulus, concolorous. Lines black, broken; a white mark submedially before t. p. line. S. t. line accompanied by broken white marks. Costal white dots evident.

Fringes cut with white. Hind wings blackish with white fringes, reflecting the band and dot of under surface. Beneath, a terminal series of black dots, very obvious and plain on primaries above. Body blackish fuscous. *Expanse* 25 mil. No. 1044. Prof. Snow, New Mexico.

HOMOHADENA EPIPASCHIA n. s.

This singular species has the look of one of the *Epipaschiæ*. Fore wings clayey gray, much shaded with black. Lines black, single; t. a. somewhat curved and thick; t. p. line widely bent, with an acute costal tooth towards base of wing; s. t. line denticulate, pale, followed by prominent interspaceal black marks, the black terminal space itself cut by pale veins; fringe dark. Hind wings blackish fuscous. Beneath, two bands on primaries and terminal black marks more faintly repeated; hind wings gray, with the band bent subterminally; a discal point. Above, a black cloud on center of disc apparently separating the pole, black clouded, undefined stigmata. *Expanse* 30 mil. No. 1013.

COPIMAMESTRA Grote.

The types of this genus are the European *Brassicæ* and a new North American species which agrees with it in structure and differs in color, so that the two species must have a common origin. Characters of *Mamestra*, except that fore tibiæ have a distinct claw. So long as one species alone was described, a separate genus might not be thought necessary. This remarkable addition to our Western fauna illustrates my theory that the northern forms in our North American fauna came by the north before the glacial epoch. (See my papers in *Popular Science Monthly*, *Silliman's Journal*, etc.) In the present case the species has not come east to our seaboard, as far as known.

COPIMAMESTRA OCCIDENTA n. s.

Eyes hairy. More blackish than *Brassicæ*. A greenish-white before s. t. line, continuous. Reniform greenish-white; a patch of same color on subbasal field. Orbicular not well marked. Lines black. Tegulæ lined with black. Hind wings pale, shaded outwardly. Discal spot on fore wings beneath pale, with central dot; on the whitish secondaries a solid dot. *Expanse* 42 mil. No. 943.

This genus may be objected to, but I cannot see any reason for overlooking the claw in *Copimamestra* and regarding it as of generic value in *Oncocnemis*. The sweeping criticism passed on my ideas of genera by Mr. Smith conveys an erroneous idea. I regard them as artificial groupings to a great extent, but I would not mix up species with armed and unarmed tibiæ, hairy and naked eyes, in one genus. I may have insisted too strongly on the value of single characters by themselves, but this is the extent of my fault, and it is largely one upon which an opinion is justifiable. The best reply is that Mr. Smith's adopted genera are sometimes based on single characters, and again on "modifications of a modification." For my part I cannot

admit such genera as *Copihadena* and *Metahadena*, the genus *Eucalyptera*, etc., nor can I understand upon what principle Mr. Smith admits them.

TRICHORTHOSIA n. genus.

Eyes hairy, lashed. Body untufted. Fore tibiæ unarmed. Middle and hind tibiæ spinose. Vestiture loose, hairy. Antennæ (female) simple. Palpi rather short, terminal joint conical. Tongue rather weak. Wings entire; costal edge of primaries very straight and even; apices sharp. Allied to *Orthosia*.

TRICHORTHOSIA PARALLELA n. s.

Olive ochrey. Fore wing with terminal space white, contrasting. Subterminal line very even, rigid, double below an apical streak, which is the continuation of the outer and narrower component dark line. Hind wings fuscous, with pale fringes. Reniform with reddish stain. Median shade well expressed. *Expanse* 28 mil. New Mexico; Prof. Snow.

In this species the lines are double, faint; the outer median line followed by pale points; the orbicular merely a dark dot; the reniform with two inferior dark points; the median shade diffuse, and marked on costa. The resemblance is to other species with pale terminal space, such as *Glaea Anchocelioides* or the species of *Agrotis* allied to *Alternata*. The costa is straight, for the group to which it belongs, being more like *Jodia* in this respect; the outer margin is full and rounded.

CATOCALA VIOLENTA Hy. Edw.

One fresh specimen of this distinct species. It is much larger than *Ophelia*, to which it comes nearest, being nearly as large as *Coccinata*, the red of hind wings being a little like that of *Aholibah* in shade. I have examined a large series of *Verrilliana* in Mr. Neumogen's collection. This latter species is found from Texas to Arizona. The red of hind wings is an orange-red, and it fades to yellow in Arizona specimens taken by Mr. Doll. The three forms are, in my opinion, entirely distinct species; the Californian *Ophelia* differing in the gloss and color of primaries, as well as in the color of hind wings, from *Verrilliana*.

CELIPTERA BUCETUM n. s.

Brownish-gray; the outer line is upright, yellow, broad-edged with dark, and followed by a diffuse shading of black scales over subterminal space. Inner line single, undulate, with an outward exsertion on medium vein. S. t. line dotted. A discal curved line, sometimes expressed by two dots. A terminal series of black points. Hind wings, ochrey-gray. Beneath, rather bright ochraceous, immaculate. *Expanse* 30 mil. No. 979.

This fine species may be known by the plain, discolorous, bright-yellowish undersurface, and is, I think, a mimetic form of some butterfly, with which it may be associated; probably some Satyr belonging to a genus allied to *Coenonympha*.

TETRACIS VIDULARIA Grote.

This is congeneric with *Eugonia Coloradaria* G. and R., and I follow Dr. Packard in referring it to *Tetracis*. The outline is more like *Alniaria*, however, than any other species of *Tetracis*. The species may be known by its pale color, the presence of only a single outer common brown line, the absence of dots above; the brown marking on the fringe; beneath all four discal markings evident, the wings more irrorate. *Expanse* 37 mil. No. 1070. Prof. Snow, New Mexico. The male has not turned up yet.

ELLOPIA VITRARIA n. s.

Male. Slighter than *Bibularia* or *Fervidaria*. Pale ochrey yellow, wings transparent in appearance. The usual lines take the form of dots on the veins and are very faint, even, not angulated. There can, I think, from this character be no question of the ever-varying *Fervidaria*. The dotted appearance of the lines is peculiar. Body light yellow. Antennæ pectinate. *Expanse* 31 mil. New Mexico.

BAPTRIA (?) ALBOFASCIATA Grote.

The single specimen is rubbed and defective, but I believe it belongs to this species, which has not been recognized since its description. So far as I see it is not *Hastata*, but probably congeneric. Fresh examples will probably soon turn up, when it can be properly discussed.

EUBYJA MEXICANARIA n. s.

Male. Size large; antennæ long, plumose. Soft brown, irrorate with black; inner line black, produced in a long tooth on the cell. Outer median line, in general shape, as in *Quernaria*, but *even* and more oblique; a black discal clouded spot. Outside of the line the wing is brown. Secondaries gray-brown; two black sub-equal mesial lines, the inner more diffuse, the median shade fused with the minute discal point, which is visible beneath. Head and thorax blackish and smoky brown. Beneath, paler, with lines reflected. *Expanse*, 60 mil. *Length of body* 22 mil. New Mexico. No. 988.

This insect shows no whitish shades; the anterior line shows a very faint paler preceding shade. A female, sent under the number 989, and which, I think, is the opposite sex of the above, agrees with Packard's figure of *Quernaria*, except that the single mesial black line of secondaries is even, with a central tooth. The white shades are much less extensive, and limited to base of primaries, and beyond the outer median line sub-terminally. Brown; lines black; inner regularly curved, outer as in male; a white discal point. Thorax, in front, white shaded. Head and collar smoky brown. Hind wings without median shade, and showing the small, white-centered discal dot plainly. Abdomen white at base above; else blackish brown. Wings paler beneath, reflecting markings. Hind wings above with white shading and dotting outside of mesial black line corresponding with outer median line of fore wings. *Expanse* 58 mil. It is evident that Packard's figure is

female *Quernaria*. This larger New Mexican species, in which the male shows no white, and the female much less than the figure, must be different. I am not certain that the two are associated correctly, and thought the female might be a form of *Quernaria*, and the male another species. *Cupidaria* is suspected to be the male of *Quernaria*, and with the differences in the lines in the two specimens before me, the possibility is that it may be so, in which case there can be no doubt that the present is distinct. At the moment, I cannot compare Abbot and Smith again, nor have I enough material to decide. *Pœnulataria* Grote, not mentioned Packard, can be neither of these species.

PHIGALIA LIXARIA n. s.

Male. Dark blackish-gray. Body slender. Antennæ pectinate. Disc crossed by three distict sub-parallel black lines, outwardly bent on costal region; the middle one more diffuse, being the median shade. A discal curved streak. Subterminal line somewhat dentate, broken, with a faint whitish shade. A terminal series of black dots. Hind wings pale fuscous, with two narrow faint lines and discal dots. Beneath pale, discolorous, no markings; a dot on secondaries. *Expanse* 38 mil. New Mexico. Number 1009.

Two other specimens belong, perhaps, to closely allied species, but on this slender material I do not describe them. One is larger and a little rubbed, while the type is fresh; the other smaller than type, and this last seems to have the antennæ less heavily pectinate.

This species differs from *Strigataria*, by the s. t. line being more bent and further from apices at costa, by the outer mesial line being more exserted medially, by the median shade being more diffuse and not running close to the anterior median line on the internal margin, by the darker color, the inner line on secondaries straight, with a median tooth and having discal dots; the lines on fore wings are distinct and black, the outer median line angulated; the new species is smoother and less irrorate. Following the variability of *Strigataria*, I would regard one of the above-mentioned specimens (No. 1010) as a variety; it is not quite fresh, and seems to differ but little. The other, with paler hind-wings and smaller, seems different because the antennal pectinations appear shorter than in both the type and the variety of *Lixaria*.

LYCHNOSEA n. gen.

Allied to *Sicya* and *Heterolcha*. Labial palpi extending straight forward beyond the front, which they exceed, the terminal joint concealed by the long vestiture. Male antennæ heavily pectinated, long, the pectinations tapering slightly and then becoming suddenly reduced at tip. Female antennæ simple. Fore wings with a distinct angulation in the female on exterior border, rounded in male; on secondaries a blunt point in both sexes. Abdomen not exceeding secondaries. Hind tibiæ with two pair of spurs.

LYCHNOSEA AULULARIA n. s.

Dull yellow. In the male the terminal border of primaries is washed with

purple brown outside the outer scalloped median line, which runs from costa to inner margin. Inner line single, faint, irregular. A discal dot. Hind wings with medial line narrow and indistinct, faintly washed with purplish, subirrorate. The female is smaller than male, paler, more yellow, still the basal and terminal field of primaries show a purplish shade. The hind wings are paler, more yellow with yellowish fringe. Beneath bright ochre yellow, strigose; in male fringe and apices purplish. A common extra mesial ochre line; faint discal dots. Male *expands* 40, female 34 mil. New Mexico and Arizona.

This may be known by the primaries being more or less purplish at base and terminally, the wing being divided into three fields by the two median lines, the outer oblique, well removed outwardly, rather regularly scalloped. The ground color is rather faded yellow, somewhat bright on the wide median space. The long palpi projected straight forwards, the converging facial hairs, the long, heavily pectinated plumose male and simple female antennæ, and the sexual difference in shape of fore wings, prevent me from referring the moth to any genus in Dr. Packard's Synopsis, nor can I recognize the species, which must be very common, among his figures or descriptions. This is one of the higher genera of the family, and should be catalogued among the first, after *Tetracis* and *Angerona*. It is singular, as before stated, that the editors of the Brooklyn "List," who show so little freedom of thought in their work and take so many liberties in their preface, should have followed Dr. Packard's arrangement in his monograph, and commenced with the lower genera. Were we in possession of a knowledge of the sub-order from the earliest time, such an arrangement would be philosophical; and, like the geologists, who commence with the primary rocks, and finish their exposition with the quartenary formations, we could ascend from the earliest to the latest species. But in the vast majority of works on botany and zoölogy, a linear arrangement commences with the highest groups, which are assumed also to be the latest to come into existence.

CHRYSEUDETON AVERNALIS n. s.

No ocelli. Pale ochrey-brown. A diffuse white sub-basal band, including a brown spot. A median white band angulated at the middle, crossed by a longitudinal discal black streak. The outer band is exserted over median veinules, and dyed within by brown scales. Subterminal white band tapers inferiorly, and does not reach the internal margin. Fringe brown. Hind wings white, with a median patch dotted with black scales; a yellow terminal line. A row of black spots on the margin, less conspicuous than usual, but faint traces of metallic scales. Fragments of two brown inner fasciæ, marked on internal margin. Beneath powdered with brownish. The white outer and subterminal bands make a V-shaped mark on fore wings outwardly. On secondaries, the terminal dots reduced. Two specimens. *Expanse* 22 mil.

APPENDIX.

For the convenience of American entomologists, the following descriptions of New Mexico moths taken by Prof. Snow, are reproduced from the *Annals and Magazine of Natural History* (London) for January, 1883:

Agrotis bimarginalis n. s.

Allied to *variata* and *observabilis*. Head and thorax rich orange-brown; a broad pale leather-brown or fawn-colored costal stripe to terminal posterior line; terminal space frosted with white. Rest of the wing deep brown, shaded with black. Transverse posterior line even; stigmata obscured by the blackish shading; subterminal space black on costa. Hind wings pale fuscous; abdomen brownish terminally. Beneath with dots and a common even exterior shade band. No. 924. *Expanse* 36 millim.

Agrotis circumdata n. s.

Belongs to the *gravis* group, the handsomest species yet found of this group. Terminal space light leather-brown, and joining an equally broad similar band along internal margin, which is edged above and below by two deep velvety black curved longitudinal stripes at base of wing. These bands vividly contrast with the black subterminal space and brownish-black surface of the wing. The dentate transverse anterior line and the even transverse posterior line partly visible. Stigmata contrasting; orbicular small, pale, with dark central dot; reniform small, pale, upright, not constricted, with brown line. Head and collar rich ochre-brown; thorax blackish. Hind wings fuscous, with reddish fringes. Beneath powdered with reddish brown, common band and discal dots distinct on secondaries. No. 925. *Expanse* 35 millim.

Agrotis planalis n. s.

Male. Allied to the *Normaniana-esurialis* species. Fore wings and thorax concolorous, dark chestnut brown; subterminal line narrow, commenced in black, with a subcostal tooth pointing inwardly, thence straightly, indistinctly scalloped to inner margin. Lines double, marked on costa; transverse posterior line faint, not much bent; stigmata small, concolorous, set in a black discal shade. Thorax a little darker than primaries above. Beneath distinctly marked. Fore wings blackish to subterminal line, beyond which the terminal space is pale; outer mesial line marked on costa; hind wings pale, with distinct extramesial line and discal dot. Abdomen brownish. Hind wings above without well-defined lines, paler at base, shaded broadly with fuscous outwardly. Antennæ slightly pectinate. No. 1043.

Agrotis grandipennis n. s.

One of the largest species, the female expands 52 millim. Rich purplish red-brown, veins marked incompletely with black, terminal black marks distinct. Transverse anterior line dentate, a large submedian tooth, lines

double, fine, black. Orbicular small, round, pale, with dark dot; a dash connects it with the shadowy reniform. Transverse posterior line marked by double costal black dots, else obsolete. Hind wings pale fuscous, veins marked. Abdomen shaded with reddish; thorax like fore wings. Beneath whitish well-defined dots. Nos. 948 and 949. All the tibiæ spinose. Allied to *piscipellis*.

Agrotis beata n. s.

Delicate dark mouse- or pigeon-gray; belongs to the *anicla* group. A black velvety band or collar in front. Lines single, faint and narrow. Transverse posterior line forming a single angle. Subterminal line pale, preceded above by a black shading, and followed by a narrow black shade. Median shade diffuse, black. Fringes pink. Hind wings nearly white, smoky outwardly. Beneath without lines or dots. Head and thorax gray, like primaries. Abdomen pale gray, somewhat reddish at tip and beneath. No. 929. A lovely species. *Expanse* 36 millim.

COPIMAMESTRA n. gen.

This agrees with *Mamestra*, except that the fore tibiæ are armed with a distinct large claw. Eyes hairy. Abdomen tufted. Tibiæ unarmed. The types are the European *C. brassicæ* and the following new species:

Copimamestra occidenta n. s.

Darker and more blackish than *brassicæ*. A greenish-white broad band before the subterminal line, continuous. Reniform greenish-white. A patch of the same color on subbasal field. Orbicular not well defined. Median lines black. Tegulæ lined with black. Hind wings pale, shaded outwardly with blackish. Beneath, the discal spot on fore wings is pale with central dot. The whitish secondaries show a well-defined dot. *Expanse* 42 millim. No. 943.

Grotella Dis n. s.

This species seems a little larger than *7-punctata*, with the dots obliterated on the white primaries. Unlike the latter, the hind wings are black with white fringes. Beneath also black, the white fringes on both wings strongly contrasting. I have been disposed hitherto to regard this as a variety. One specimen also in Mr. Neumoegen's collection from Arizona. *Expanse* 26 millim. New Mexico. No. 1018.

The contrast between the white primaries and blackish secondaries on the upper surface is peculiar. If only a variety it is one worthy of a separate designation.

PROCHŒRODES, Gr.=*Eutrapela*, Packard.

According to Mr. Butler, the genus *Chœrodes* is preoccupied in Coleoptera. I have shown, in the "Canadian Entomologist," that *Eutrapela* is used by Hubner first for a species of *Selenia*; and, in including *clemataria*, Hubner may have thought the moth congeneric. A new name is therefore necessary for our genus, with *transversata*, Drury, as type. Guénée's limitation of *Eu-*

trapela to *clemataria* is not followed by Dr. Packard, whose genus *Eutrapela* corresponds with *Chœrodes* of Guénée plus the *Eutrapela clemataria* of the "Species Général."

Prochœrodes catenulata n. s.

Female: Allied to *nubilata*, but differing by the wings beneath being pale and having a continuous, even, dark outer line *dotted* or *accented* on the veins, equally distinct on both wings. All the wings show the black discal dots equally distinct above and below. Base of primaries grayish ochrey, defined by an irregular brown line, bent outward on cell. Median space fawn-brown, freer from strigæ than wing elsewhere. Outer line brown, angled to costa, followed by a diffuse blackish subterminal shade, continued more faintly on secondaries. Outside the transverse posterior line, both wings grayish, as at base, and the strigæ are, here as there, again prominent. Apex acute; outer margin with a rounded angle, less defined than Packard's figure (61); hind wings with smaller angle and with the tips of the veins determinate. A larger insect, apparently, than the Californian species. *Expanse* 45 mil. The black terminal clouding is continuous and reaches apex.

Phasiane cruciata n. s.

Gray; inner line black, slightly outwardly bent at middle; the close and parallel median shade runs straightly down, and at the bend touches it; a curved shade line before the black inner line; so that here we have three lines close together and partially fused, differing in distinctness. Outer line black, sinuous, bent outwardly on costal region, the subterminal, fainter, runs close to it, and they nearly touch opposite the cell; at the place of the subterminal line the wing is whiter, free from speckles or strigæ, also on median space. Hind wings gray, finely irrorate; fore wings reflecting lines. No. 1002. *Expanse* 27 mil. Easily known by the transverse anterior line forming two forks from its middle junction with the median shade. Discal dots very small.

Caripeta æqualiaria n. s.

Female: Close to *angustiorata*. Fore wings rich rosy brown and ochrey brown, the paler shadings being whitish yellow. Transverse anterior line upright, dark brownish, the cells before it to base being diffusely filled with yellowish white. This line in its ally forms a wide tooth, narrowing the median space which is here wanting, the median lines being subparallel and the median field of the same width. Two indistinct pale spots on the cell. Outer line followed by a narrow diffuse yellow-white shade, like anterior line, toothed at extremity of median vein. Subterminal line a succession of dark brownish blocks on interspaces, followed to the edge by yellow-white triangular marks. Hind wings whitish, shaded on veins with yellow. Thorax fawn. Beneath reflecting markings; hind wings with a broken ochre line. *Expanse* 38 mil. New Mexico. No. 995.

Parœdis obliqualis n. s.

Front flat; maxillary palpi stout and scaled, as long as the labial, ap-

pearing between them and the front. Allied to *funalis*, and similarly sized. Gray, shaded with smoky and brown. Inner line single, oblique, very faint, apparently angulate on cell. Outer line parallel with this, *even* and oblique, preceded by a faint white shade. Subterminal line black, denticulate, running from apex inwardly to a point below the middle, whence it runs close and parallel to the outer line to the internal margin; it is touched with white below the middle, after which it is even and black. There is a wide brown clouding across the wing from the outer line to the external margin opposite the cell; above internal angle a large free gray space. Fringes dark. Reniform a faint, quadrate, upright, blackish, shaded spot. Hind wings pale fuscous, with two subterminal lines: the outer is flecked with white before anal angle; and opposite this flecking, the fringes are touched at their tips with black. There is a dotted line on secondaries beneath; and on fore wings the reniform is very distinct, blackish, and square. As compared with the figure of *Parœdis funalis*, N. Am. Ent. i. pl. v. fig. 4 (fore wing, sub *Ædis*, changed to *Parœdis* in "New Check List"), the *even* outer median line will distinguish *obliqualis*. Attention must be paid to the structure of the head in this and allied genera to locate the species. No. 1019.

Crambus dimidiatellus n. s.

Size large. Costal region broadly olivaceous, edged by a darker linear shade below. Rest of the wing with the veins striped with white, and covered medially by a broad white shade, widening at external margin; below this the ground-color is again somewhat olive. Hind wings and fringes pale silky fuscous. Fringes and fore wings white, faintly dotted. *Expanse* 36 millim. No. 968. Labial palpi long; approaches the *propexus* group. I do not know the male.

Nephopteryx auranticella n. s.

Although I have but a single specimen, very bright, the extraordinary color and size will enable the species to be at once recognized, and perhaps better placed when the male is known. Fore wings bright orange-red, color of *caripeta*. A white somewhat diffuse longitudinal stripe from base to end of median vein, followed by slight oblique white clouding. Subterminal line white, contrasting with the red wing, running inwards a little on costal and internal margins. The wing is more yellowish or orange at base, redder outwardly. Tegulæ and sides of collar orange. Head above and collar centrally white. Legs red outwardly; palpi red, white at base. Thorax beneath white. Hind wings pale translucent fuscous, with a fine terminal line and white fringes, interlined at base. Beneath yellowish fuscous, with a red mark on primaries at costal inception of transverse line. *Expanse* 30 mil. New Mexico. No. 1021. This brilliant species wants the usual inner transverse line on fore wings above.

ADDITIONS TO THE LIST OF KANSAS COLEOPTERA IN 1881 AND 1882.

BY PROF. F. H. SNOW, OF THE UNIVERSITY OF KANSAS.

With four exceptions the forty-nine species of the following list were taken in Douglas county, within five miles of the University, by the writer, assisted by the students of his classes in zoölogy. Among these students, L. L. Dyche, Cara E. Fellows and W. S. Bunn have manifested unusual enthusiasm in the search for new material in a locality whose coleopterous fauna had already been quite thoroughly investigated. The four species not found in Douglas county are *Dynastes tityus* from Chautauqua county (J. T. Bradley), *Lachnosterna submucida* and *Lepyrus gemellus* from Davis county (J. V. Humphrey), and *Hemirhipus fascicularis* from Leavenworth county (T. B. Ashton). This list of addenda increases the number of coleoptera known to occur in the State to 1,904 species, and keeps Kansas still at the head of the list of States in the extent of its beetle-fauna. This fact may be considered to have a "practical application." Great diversity of insect life indicates a corresponding diversity of vegetation, and shows a natural adaptability of soil and climate to sustain a great agricultural commonwealth.

For the determination of many of the species I am greatly indebted to the kindness of Dr. John L. LeConte, of Philadelphia. The numbers prefixed to the species are those of Crotch's Check-List:

164. Nomaretus cavicollis *Lec.*
775. Chlaenius prasinus *Dej.*
867. Anisodactylus lætus *Dej.*
938. Harpalus fallax *Lec.*
1334. Ilybivins biguttalus *Germ.*
1368. Gaurodytes punctatus *Mels.*
1563. Trichopteryx aspera *Hald.*
1741. Mycetoporus lucidulus *Lec.*
1755. Quedius lævigatus *Gyll.*
1900. Scopæus exiguus *Er.*
——. Scopæus undescribed.
——. Philonthus Snowi *Fauvel.* n. sp.
1819. Philonthus flavolimbatus *Er.*
1919. Pinophilus parcus *Lec.*
7871. Pycnoglypta lurida *Gyll.*
——. Hydnobius n. sp.
2331. Baeocera apicalis *Lec.*
——. Bitoma 4-guttata.
——. Cryptophagus sp.
2647. Bothrideres exaratus *Mels.*
2730. Carpophilus mutilatus *Fab.*
2735. Epuræa corticina *Er.*
2810. Olibrus bicolor *Gyll.*
2831. Hippodamia 15-maculata *Mels.*
3091. Epierus planulus *Er.*
3117. Anapleus marginatus *Lec.*
3165. Saprinus fraternus *Say.*
3544. Lachnosterna submucida *Lec.*
3579. Anomala flavipennis *Burm.*
3627. Dynastes tityus *Linn.*
3877. Fornax Hornii *Bv.*
3936. Hemirhipus fascicularis *Fab.*
4083. Monocrepidius suturalis *Lec.*
4729. Clerus ichneumoneus *Fabr.*
4841. Eupactus nitidus *Lec.*
——. Luperus not described.
5901. Batophila cyanipennis *Cr.*
8584. Chaetocnema æneola *Lec.*
5960. Microrhopala vittata *Fab.*
6335. Bolitophagus corticola *Say.*
6572. Orchesia gracilis *Mels.*
——. Diclidia n. sp. (?)
6613. Mordellistena trifasciata *Say.*
6654. Mordellistena hebraica *Lec.*
——. Mordellistena rugifrons *Smith.* n. sp.
8890. Lepyrus gemellus *Kirby.*
9182. Conotrachelus geminatus *Lec.*
9227. Tyloderma variegatum *Horn.*
9327. Baris aerea *Boh.*

OBSERVATIONS OF THE NESTING HABITS OF THE GUILLEMOTS AT BIRD ROCK.

BY COL. N. S. GOSS, TOPEKA.

When at "Bird Rock," Gulf of St. Lawrence, July 9th, 1880, I was informed by one of the men that had been in the employ of the "Keeper of the Light" for several years, that the Guillemots, with a narrow white line encircling the eyes and running back from same to ears ("White-eyed," as he called them), nested around the edge, and at the top of the rock, laying their eggs on the earth that had fallen down, and never on the bare rock, like the other *Lomvia arra*, nor below with them on the narrow shelf-like projections on the sides of the perpendicular cliff. I at once examined with glass from the different points I could reach from the base of the rock, and sure enough, the "white-eyed" encircled the top, and *L. Arra* the sides. I also shot over thirty from the sides, and in no case killed or started the "white-eyed." But few of these birds were nesting at the rock as compared with the thick-billed; I would think one to a hundred a fair estimate. I collected from both kinds a few fresh eggs, but most of the eggs examined were nearly ready to hatch, and among them young birds, some at least a week old. Color of the eggs of the "white-eyed" grayish white, streaked with zigzag lines of dark, reddish brown; eggs of *L. Arra*, greenish blue, thickly blotched around large end; the rest rather thinly spotted and specked with dark, reddish brown, some of the spots nearly or quite black—all without streaks, or nearly so.

In setting, the egg (one only) rests upon a bare spot in the center of the abdomen, which prevents the birds from setting close—in fact, causes them to assume a half-standing position; and as they all face the water, looking like sentinels guarding the gannets, and Kittiwake gulls that occupy the wider shelves, and with its rock back-ground, waves wildly breaking against its base, and thousands of birds circling and screaming above, forms an impressive sight, one that will never grow dim in memory.

I can find no mention of this difference in the nesting habits of the two birds. My stay (only one day) was too short to examine the rock from the base except on the sides approached, and it may be that the "white-eyed" occasionally nest on the sides of the cliffs below the top; and I write this more to call the attention of those that have visited, or that may hereafter visit the Bird Rock, and to ask in case they are so found that it be ascertained, if possible, whether the eggs in all cases are laid upon the soil collected thereon.

Should my observations prove to be the uniform nesting habits of the birds, it will be of value to zoölogists, as it will enable them to determine the kind or kinds of eggs they may have; some of the eggs will be lighter or darker

in color, and more or less thickly or thinly marked, but the narrow zigzag lines in the one case, and the almost wholly want of same upon the other kind, together with their deeper ground color, will, I think, be too apparent for doubt. In shape and measurement the eggs vary about alike, running from 3 to 3¼ inches in length, by $1\frac{8}{100}$ to $2\frac{1}{100}$ inches in diameter.

I will further say of the eggs examined, the "white-eyed" were very uniform in color and markings, which was not the case with *L. Arra*, and as many of the birds nesting with the latter were blacker in color and their bills smaller, I am inclined to think further examination will prove them to be the true *Lomvia Troile*, and the ones I have spoken of as the "white-eyed," be restored to their former name, *Lomvia Ringvia*, and not an individual phrase of *L. Troile* as now thought and classified.

NOTES ON MELEAGRIS OCELLATA, CUVIER.

BY GEO. F. GAUMER, SANTA FÉ, NEW MEXICO.

Head and upper part of neck destitute of feathers, and sparsely covered with short bristles. There are about twenty-four fleshy processes arranged in two rows on the front part of the neck, and about twenty more of the same kind form two rows over the head; many smaller ones are scattered over the head. At the point of union of the bill with the head, there is a long fleshy process capable of much erection and distension. Behind this the fleshy scalp is permanently elevated, so as to form a flat-topped pyramid, with its greatest length from bill to occiput. The wing is comparatively small; the seventh primary is generally the longest; this, however, varies in different individuals, from the fifth to the seventh. The tail is composed of eighteen feathers, (and not fourteen as stated by authors;) these are graduated quite evenly, and diminish successively about three-quarters of an inch.

The tarsus is long and stout; anteriorly it is covered by a double row of pentagonal scales; there is also a double row of similar ones behind; the external row extends two scales below and the internal row just to the spur. The sides have small, oblong, oval and hexagonal scales. The male is provided with a long, sharp spur, the center of which is about two inches above the sole of the foot. It stands nearly perpendicularly to the tarsus, and is directed postero-internally. In the full-grown male the spur is about two inches in length, conical, slightly compressed, and decidedly curved upwards towards the tip. All the feathers are broad, and give a peculiar scaly appearance to the bird.

General color, dark metallic emerald-green. Every feather has a conspicuous terminal fringe of the most brilliant metallic gold and bronze. On the lower part of the neck the body of the feather is emerald green; between

this and the narrow gold fringe is a narrower band of velvety black. The upper tail coverts, and tail feathers have about thirty narrow transverse bars of dark brown, alternating with an equal number of white ones, which are mottled with darker. In most of the specimens these bars are lost in the fine mottlings of gray. In addition to this, there is in the old male a distinct rufous tinge over all this part of the feather, more or less distinct according to age. The fringe, which rests on a solid band of burnished gold, is about three-quarters of an inch long, and is of the most brilliant metallic bronze, changing to an iridescent green. Between this and the gray mottling there is a double eye-spot of metallic blue, with purple reflections. These spots are very showy, and generally surrounded by a velvety-black band about three-sixteenths of an inch in width, the ends of which meet the shaft in such a way as to form a heavy, black, W-shaped figure. From the neck to the tail the plumage passes insensibly through all the gradations and changes from the simple markings and colorings of the former to the gorgeous beauty of the latter. The primaries are transversely barred with black and white. In all young specimens the black bars are wider, and the black prevails, while in the older specimens the white predominates. The larger wing-coverts, which form a conspicuous band on the wing, have their outer webs of a beautiful iridescent bronze color. The feathers of the breast and other under parts are deep black, with occasional reflections of green and purple, and each feather is tipped with bronze. The under tail-coverts have nearly the same markings as the upper, but the colors are if possible brighter and more striking. The naked skin of the head and neck is of a bright azure blue, except the fleshy processes, which are bright crimson or scarlet. Spurs and claws, dark horn-color; tarsus and toes, bright rose-color; iris, reddish-brown. Length, 40.12 inches; wing, 16.25; tail, 14.00; extent of wings, 48.00. The female differs from the male only in size, being very much smaller; the absence of the spur; the head, which is less ornamented, and the colors generally, which are possibly a little less brilliant and showy.

When seen at a distance and in the shade, the Golden Turkey is of a pure velvet-black color, but when he approaches the hunter in a brilliant tropical sunshine, with the tail spread and feathers raised, this most gorgeously attired of all American birds seems a miniature world of sparkling gems set in burnished gold, silver and bronze. Tongue cannot tell, pen describe, nor artist paint the splendor of its plumage.

This bird was once abundant in Yucatan, Guatemala and Honduras. At present it is seldom seen in the settled portions of the country, and is only occasionally met with in the uninhabited forests beyond the limits of civilization. It is the shyest of all living birds, is a swift runner and a good flier. It cannot be trapped, and can only be shot at night and when asleep, and then with the utmost caution in approaching, as it is easily startled, and flies as well at dead of night as at mid-day. Like all the turkeys, the *M. ocellata* is gregarious, and is sometimes seen in very large flocks. I once counted sixty-two roosting on three trees which stood closely together.

Each flock has a leader, who seems to control all its movements. At nightfall he selects a tall tree with suitable branches, and after finding a comfortable place for himself, his companions fly up one by one, until all are accommodated. When frightened, the leader utters a short, quick cluck, and the whole flock almost instantly disperses, each individual flying away to some distant tree, where alighting, he remains awake until morning. They spend the day upon the ground, where they find an abundance of food by scratching among the leaves. The Golden Turkey is omnivorous, feasting alike on grass, grains, fruits and insects. When in the fields he fills himself with corn, and is especially fond of the roots of the poison yucca, which is extensively cultivated for starch. In the forests he prefers the fruit of the sapote, and is equally delighted to find a nest of white ants, which he devours with avidity.

About the middle of May, the female builds her nest. She generally selects the top of a fallen tree, or other thicket, where she is safe from the jaguars and cougars. A slight excavation is first made in the ground, then a few small sticks and leaves are so loosely placed in and about it as scarcely to deserve the name of nest. When completed, the eggs appear, and as the days come and go the number increases until the nest contains from eight to sixteen. In size, shape and markings, these so closely resemble the eggs of the domesticated turkey that a description of them would be unnecessary. If frightened from the nest, the female never returns; but when unmolested, and the young chicks are all hatched, she becomes very bold, and will fight for her young even at the risk of her own life.

The Golden Turkey is much hunted by the natives of Central America for its fine flesh, so that at the present rate of extermination this beautiful bird must ere long become extinct. All attempts to domesticate it have failed, as well for the native as for the foreigner who has experimented with it. In 1879, while in southeastern Yucatan, I purchased more than two hundred of these eggs from the Indians. About half of the eggs were given to tame turkey hens to hatch, others were placed under common hens, while still others were hatched by artificial heat. Almost every egg hatched, and the young chicks for a time thrived and looked well. The ones hatched in the house first refused to eat, drooped their wings, and one by one all died. The broods were then distributed among the best Indian families, where I visited them occasionally; and although well cared for, before they were half grown all had died but six. These were the survivors of a brood of twelve, which had been let run at large with an old turkey hen. They lived in the woods, and became very shy. In the summer of 1881 these were taken to Tamax, a distance of about fifty leagues, where two of them soon died. The other four were again set free with their foster-mother; and before they became accustomed to the place, two of the four went to the woods and never returned. The other two I brought to New York in July, 1881, where they were sold to Messrs. Chas. Richie & Brother.

would this account for the mutilation, even were the conditions of the nest favorable; for the web of the feather is arranged laterally upon the shaft of the feather, which would require a vertical motion to wear it away, while the motion of the bird's tail is transverse to its own body, as also to the nest—a motion only calculated to wear away the shaft from beneath.

Some of the Momotidæ are very tame, and seem to have no fear of man, but rather to prefer his company, making their nests in his wells and in his cellars. Such is the *Eumomotus superciliaris*, a species whose habits I have studied more than all others.

During my residence of nearly four months in the city of Temax, near the north coast of Yucatan, about twenty of these birds lived in a well from which I used water every day. The water was drawn by means of two buckets attached each to the end of a rope, which played over an iron pulley. The well was almost forty feet deep, had been cut through a porous shell-limestone, and its walls contained many cavities into which a man could crawl many feet, but was obliged to back out. Within these cavities live the motmots, and oftentimes very venomous little reptiles, called "canchæ" by the natives. But, risking the poisonous serpents, I have frequently gone many yards into these caverns to investigate the home of the saw-bills and their work therein, and I have always come out feeling well repaid for all the danger, having invariably seen something new and interesting. At one time I have found only the nest, with four or six roundish, white eggs, with the shell so thin and transparent that the yolk was plainly visible; at another, I have found the young birds in almost every state of development—those with the tail feathers just starting being always the most interesting. The feathers all seem to grow alike to a certain point, except the middle ones, which are always a little broader towards the end; there all cease to grow except the two middle ones, which soon pass the others by about an inch and a half. Up to this point the webs of these two feathers are just the same throughout, except the subterminal portion, which is much narrower. Thus far no mutilation has taken place, but as soon as these feathers exceed the others a little more, the web begins to disappear, and the outer web of each feather is generally taken off first. This, however, is not always the case, as the inner web sometimes goes first. In very few cases have I ever seen a web trimmed farther up than just to the ends of the other tail feathers; and just as these pass the shorter ones, so are they trimmed until their growth ceases.

I have never seen the bird arrange its feathers, and especially not its tail, when above-ground, though I have seen them work for a long time with the bill, arranging the tail, while they were in the well—catching hold of it and drawing it around, first on one side, then upon the other, always using the point and not the whole of the bill.

On examining the bill, it is found to be dentated in the middle portion and smooth at the tip and base. The smooth portion of the tip of the upper

fact, it is not unreasonable to suppose that the remaining web, either in its superior or inferior part, would show some signs of wear, and at least have a rough appearance—that the shaft itself would show the same wear, or would be polished; and should none of these signs be evident, we would expect to find young birds with entire feathers. To the contrary, however, the nest is not generally so constructed as to bring the naked shaft upon the edge of the nest, but is frequently smaller, and even the shorter feathers of the tail rest as well upon its rim, and the tail is not kept in motion except when the bird is aware of some danger or the presence of man. Neither does the remaining web ever have a roughed appearance, but is invariably smooth, though often unevenly trimmed. The naked shaft, which is grooved beneath, never shows any signs of mutilation; and young birds which have never mated have the plumes more exquisitely formed, and the shafts more evenly trimmed, than the adult birds of two and three years.

Still others say that these birds formerly flew very awkwardly, turning many somersaults in the air, on account of the tail being so long and broad that it caught so much air as to overbalance the bird; that in this condition it was found by the mischievous little king-bird, which caught the tail of the motmot either to assist him or to play some prank, as boys will sometimes do with a clumsy playfellow; that in the act of so doing the web slipped off from the motmot's tail, and the latter finding himself free flew away with such ease and grace that immediately the other motmots adopted the new fashion and all trimmed their tails, and that from that day to this the motmot flies as well as other birds!

This is a peculiar combination of accident, reason and pride which it would scarcely need argument to disprove.

After over two years of careful observation, I am quite sure as to *how* this mutilation is effected. My observations I therefore give as briefly as possible.

The Momotidæ all live beneath the surface of the earth; some live in the deserted dens of the armadillo and other burrowing quadrupeds; some live in caves, some in the crevices of the rocks and cliffs, while others take up their abode nearer the homes of men, living in wells and senotes.

Their food consists of small frogs, worms, and such other things as their subterranean abodes furnish them, with a few insects which they catch while on the wing. They are seldom seen in bad weather, early in the morning, in the heat of the day, and never at night. This exclusion from light, and exposure to perpetual moisture, gives to them a loose, pale flesh, and almost colorless blood, and soft muscles, thus rendering them very lazy and stupid, though they sometimes retreat very quickly when the hunter tries to get a shot at them.

The nests are made in some secluded corner of their underground homes. They consist of sticks and mud, or grass and mud, and are seldom large enough for the bare shafts of the tail feathers to rest upon their rim. Nor

would this account for the mutilation, even were the conditions of the nest favorable; for the web of the feather is arranged laterally upon the shaft of the feather, which would require a vertical motion to wear it away, while the motion of the bird's tail is transverse to its own body, as also to the nest—a motion only calculated to wear away the shaft from beneath.

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On examining the bill, it is found to be dentated in the middle portion and smooth at the tip and base. The smooth portion of the tip of the upper

mandible fits very closely with the lower one, something after the fashion of scissors, and they are therefore well adapted to their work of feather-trimming.

On closer inspection of the shaft, we find that traces of a web still remain, showing that it did not come so by a natural growth; so that after a careful examination of the structure of the bill, and considering the unevenness of the missing webs as well as the time of its disappearance, we must conclude that what nature does not do by narrowing the feather, the bird by its natural instinct of beauty and symmetry does with its bill.

A CONTRIBUTION TO THE HISTORY OF THE FRESH-WATER COPEPODA.

BY F. W. CRAGIN, Sc. B., WASHBURN COLLEGE, TOPEKA.

The study of the fresh-water Copepods, or oar-footed *Crustacea*, of North America, has, until recently, been quite neglected. Within a few years the diligence of two or three naturalists, mainly of Professor Forbes, of the Illinois State Laboratory of Natural History, has given us substantial contributions to the knowledge of this interesting part of our fauna.

As early as 1818, Say described an American species of Cyclops; but his description, like those of Haldeman, Dana, and several later authors, is imperfect and not of specific value.

The free-swimming *Copepoda* known to inhabit inland waters are as follows: *Centropages, Osphranticum, Diaptomus, Heterocope, Epischura, Limnocalanus, Temora, Cyclops, Tachidius, Canthocamptus*, and *Attheyella*. Of these eleven genera, four — *Diaptomus, Limnocalanus, Cyclops*, and *Canthocamptus* — have been recorded as common to the fresh waters of the Old World and the New. I add *Heterocope* on the authority of my friend, Mr. William Patten, who informs me that a species is common in Watertown, Massachusetts.

Tachidius, in the Old World is known only in waters made salt or brackish by the ocean; but a species has been found by Mr. V. T. Chambers at Big Bone Springs, Kentucky, in moss wet with the mineral water.

Temora, in the Old World has been found in both salt water and fresh; but in America has not yet been discovered in fresh water.

Osphranticum and *Epischura* are known only in North America, having been described recently from Lake Michigan and Normal, Ill., by Professor Forbes.

Attheyella is as yet known only in Great Britain, one of its species living in the damp roof of a coal mine.

Centropages is an oceanic genus, but has been found also in the fresh-water lakes of Kerguelen's Island.

The genus *Cyclops* appears to have been the *bête noire* of American naturalists. Comprising upwards of sixty valid species, many of which are described in Latin, German, Danish or Dutch, and several of which have been locked up in the Russian language, and the separation of species usually depending, not upon single gross characters, but upon sets of microscopic and often recondite details, it is hardly strange that American naturalists should have neglected this genus for the study of others promising their labor larger and quicker returns. We are not surprised, then, to find that but three valid species of *Cyclops* have as yet been recorded from North America, and that in our latest and best zoölogical text-book, written by something of a specialist in insects and *Crustacea*, the long-since defunct and quartered "*Cyclops quadricornis*" is cited as type of the *Entomostraca*.

I have given some time, during a part of the last two years, to the study of the free-swimming *Copepoda* of the fresh waters about Cambridge, Mass., and the present paper gives the major part of the results of those studies, together with a translation of the descriptions of *Cyclops* by Poggenpol, published in the Bulletin of the Friends of Natural History, 1874, vol. X, part 2, page 70 *et seq*. The translation has been made, so far as practicable, a literal one, and is the work of Mr. Ivan Panin, A. B., of Concord, Mass., to whom the Russian language is native, and whose thorough knowledge of English and Latin has made it possible to obtain an accurate translation of the technical terms.

Before passing to the list of species, I would note the occurrence of *Lagenella mobilis*, Rehb. in North American *Cyclops*. Before Rehberg's description of *Lagenella mobilis* (Abhandl., vom naturwissch. Vereine zu Bremen, Band VII, Heft 1, 1880, p. 68, Taf. IV) came under my notice, I had observed and made drawings of this curious gregarine, parasitic in *Cyclops*, at Cambridge, Mass. Though only described in 1880, it appears to have been previously noticed by Vernet (Observations Anat. et Physiol. sur le Genre *Cyclops*), and doubtless has the same cosmopolitan distribution as does the genus, its host.

In the list which follows, the dimensions given are those of females, unless otherwise stated. The apical caudal setæ are numbered outward.

Cyclops elongatus, Cls. (Pl. I, figs. 1 and 19–23.)

Observed sparingly in a rain-pool near the Cambridge Museum of Comparative Zoölogy.

Cyclops signatus, Koch, var. nov. *fasciacornis*. (Pl. II, fig. 15.)

The ditches near Glacialis Pond yield a *Cyclops* which agrees well in structural characters with *C. signatus*, Koch, but which differs from the European *signatus* so markedly in coloration as to constitute a distinct variety. The color-pattern appears constant for localities about Cambridge.

The general ground color is a pale blue-green, and is for the most part hidden by blotches of shining brown. The caudal segments and the alimentary tract are of a beautiful blue. The antennæ, for the most part colorless, have the basal joint brown, the distal portion of the fourth and all of the fifth stained less deeply with the same color, the thirteenth and fourteenth tinged with a still lighter shade of the same, and the apical joint also showing a faint tinge of it.

Length, exclusive of caudal setæ, 1.65–1.71 mm.

Cyclops tenuicornis, Cls. (Pl. II, figs. 1–14.)

This species is quite common about Cambridge. Agreeing in all its gross structural characters with the European descriptions of *tenuicornis*, it still seems to differ from the same in some of the finer details of its armature. These details, if actually lacking in European representatives of the species, are sufficient to characterize the American type as a distinct variety; but I strongly suspect that they have been overlooked in the European type, and shall therefore merely point them out, leaving the question of identity to be settled by those who command European specimens.

Either side of the fifth thoracic segment is furnished with three transverse rows of serrulations, of which the posterior one is marginal; and each of these is continued by a fainter line of more minute serrulations, which extends across the upper side of the segment. The second maxillipeds have, beside the large setæ and the small cilia of the anterior and posterior margin, a ring-like cluster of very flexible cilia, which possibly constitute a special sensory organ, on one of the broader sides (that next the (?) median line of the body) of the basal joint near its distal end, and a smaller and somewhat similar cluster nearer the base of the same joint. A small area at the base of the mandible is thickly studded with sharp points which resemble rapidly tapering cones.

Length, exclusive of caudal setæ, 1.74 mm.

Cyclops viridis, Fischer. (Pl. IV, figs. 8-16.)

Cambridge. Taken from the pond in the Botanic Garden.

Cyclops pulchellus, Koch. (Pl. I, figs. 2-8.)

Cambridge. I have seen but a few specimens; these from a rain-pool near the Museum of Comparative Zoölogy.

Cyclops Thomasi, Forbes. (Pl. III, figs. 1-13.)

Body slender. Sides of the fourth segment postero-laterally produced into recurved angles, a slight approach to which angulation is seen in the second and third segments. Lateral angles of the fifth, pinched into a slight fold or notch just back of the apex. (In the male, none of the segments are produced into angles at the sides.) In the first abdominal segment, a lateral indentation marks off the much-dilated anterior from the tapering posterior portion. The last three abdominal segments do not taper individually, nor scarcely as series. Posterior border of the last abdominal segment set with a fine

pectinate fringe. Caudal rami slender; six to seven times as long as broad; fully equal in length to the two and a half segments immediately preceding. Each ramus bearing six finely-plumose setæ, and on the outer side, at about one-fourth its length from the base, a short transverse row of six to eight point-like spines, similar to those which constitute the pectinate fringe of the last abdominal segment. Of the four apical setæ, the first is much shorter than the furca, the fourth still shorter, the second fully three times as long as the furca, and the third about half as long as the second. The webs of the second and third extend well toward the ramus. First antennæ, seventeen-jointed, scarcely reaching the third body-segment. (Nearly reaching the fourth segment in the male.) Labrum usually with eleven teeth. The armature of the swimming-feet is as follows:

FIRST FOOT.

(*a.*) *Outer branch.*		(*b.*) *Inner branch.*	
Basal joint.....	exteriorly, one spine. interiorly, " seta.	Basal joint.....	ex., unarmed. in., one seta.
Middle joint..	exteriorly, one spine. interiorly, " seta.	Middle joint..	ex., unarmed. in., two setæ.
Apical joint...	exteriorly, two spines. apically, " setæ. interiorly, " setæ.	Apical joint...	ex., one seta. ap., one spine, one seta. in., three setæ.

SECOND FOOT.

Outer branch.		*Inner branch.*	
Basal joint.....	ex., one spine. in., " seta.	Basal joint.....	ex., unarmed. in., one seta.
Middle joint..	ex., one spine. in., " seta.	Middle joint..	ex., unarmed. in., two setæ.
Apical joint...	ex., two spines. ap., one spine, one seta. in., three setæ.	Apical joint...	ex., one seta. ap., one spine, one seta. in., three setæ.

THIRD FOOT.—Like second foot.

FOURTH FOOT.

Outer branch.		*Inner branch.*	
Basal joint.....	ex., one spine. in., one seta.	Basal joint.....	ex., unarmed. in., one seta.
Middle joint...	ex., one spine. in., one seta.	Middle joint...	ex., unarmed. in., two setæ.
Apical joint...	ex., two spines. ap., one spine, one seta. in., three setæ.	Apical joint...	ex., one seta. ap., two spines. in., two setæ.

Inner of the two apical spines of the inner branch of the fourth foot half the length of the outer. Fifth foot composed of two joints, of which the apical is well developed and about half as wide as the basal; the basal bearing at its outer angle a rather short seta, the apical bearing one rather short and one long seta. Ovisacs small, broadly elliptical, with major axes parallel to the sides of the abdomen, which they partly cover. Each ovisac contains from thirteen to twenty-two (usually sixteen to twenty) large eggs. Animal yellowish white, or sometimes particolored in yellow and white. (In the male, the yellow first abdominal segment contrasts with a lighter-colored segment preceding and following.) Ovaries often colorless, but becoming darker as the eggs approach maturity. Ovisacs varying from dark blue-gray in the earlier to almost colorless in the later stages of the development of the contained eggs.

Length of animal, exclusive of caudal setæ, 1.11 mm. (Male, .92 mm.)

The present species differs from *Leuckartii* in having shorter antennæ, whose last three joints are subequal; in the size and armature of the apical joint of the fifth foot; in having more slender caudal rami, the relative lengths of whose apical setæ are different from those of *Leuckartii;* in the possession of a very characteristic transverse row of point-like spines on the outer side of the caudal ramus; and in lacking a crenulate contour for the dorso-basal margin of the second maxilliped. From *abyssorum, lacustris,* and *scutifer* of Sars, it differs in the armature of the swimming-feet, caudal rami, etc.; from *simplex,* Pogg., in the form of the body, first abdominal segment, fifth foot, and caudal rami. I have studied it at intervals for over two years, and had given it the manuscript name "*urbanus,*" in allusion to its abundance in cities; but it is clearly identical with the recently described *C. Thomasi,* Forbes. Prof. Forbes has the honor of having published the first new and valid species of *Cyclops* that has yet been recorded from North America.

I have most commonly observed *C. Thomasi* in the water-supplies of Boston and Cambridge, Mass. It is (in winter and spring, at least) easily obtainable in any house of either city, greatly outnumbering all other species of *Cyclops* that pass through the faucets.

Cyclops magnoctavus, sp. nov. (Pl. III, figs. 14–23.)

Cephalothorax subelliptical. None of its segments angulated at the sides. Its first segment longer than the rest of the thorax plus the first two segments of the abdomen. Its last segment, which is not wider than the first of the abdomen, is set apart from the rest so as to seem like an abdominal segment, and bears at either postero-lateral margin a fringe of delicate hairs. Posterior part of first abdominal segment slightly tapering; anterior part not dilated. Posterior margin of last abdominal segment bearing a pectinate fringe. Caudal segments about four times as long as broad, and bearing two superior and four apical setæ. Of the apical setæ, the first is longer than the spine-like fourth, but shorter than the furca; the second about as long as the last three abdominal segments plus the furca; the third but little shorter than the second. Webs of the second and third composed of delicate cilia, which extend well down toward the ramus. Eye large, dark red; deeply divided by a median constriction posteriorly. First antennæ composed of twelve joints and reaching, when reflexed, beyond the cephalothorax —sometimes nearly to the middle of the first abdominal segment. Their eighth and ninth joints are both longer than either of the last three, the eighth being the longest of all. Each of the last three bears a plain longitudinal ridge. Last joint of second antennæ considerably more slender than the others. Labrum with ten to thirteen teeth. The armature of the basal and middle joints of the swimming-feet is like that of *C. Thomasi;* that of the apical joints is as follows:

First Foot.

Outer branch..... ex., three spines. ap., two setæ. in., three setæ. | Inner branch..... ex., one seta. ap., two setæ. in., three setæ.

Second Foot.

Outer branch..... ex., three spines. ap., one spine, one seta. in., four setæ. | Inner branch..... ex., one seta. ap., two setæ. in., three setæ.

Third Foot.

Outer branch..... ex., three spines. ap., one spine, one seta. in., four setæ. | Inner branch..... ex., one seta. ap., two setæ. in., three setæ.

Fourth Foot.

Outer branch..... ex., two spines. ap., one spine, one seta. in., four setæ. | Inner branch..... ex., one seta. ap., one seta-like spine, one seta. in., two setæ.

Fifth foot uni-articulate, trisetose. Ovisacs small, sub-oval, nearly or quite meeting above the abdomen, and usually containing from five to eight eggs.

Animal dirty blue-green; antennæ lighter. Dark green pigment-masses are scattered beneath the integument in various places, particularly along the anterior side of the first antennæ.

Length, exclusive of setæ, .68 to .78 mm.

A very distinct species, belonging to that section of the genus which includes *Cyclops serrulatus*, Fischer, *C. varicans* and *macrurus* of Sars, and *C. alajensis*, Uljanin.

Cambridge. Very abundant in the dirty water of the blind ditches connected with the artificial pond known as "Glacialis."

Cyclops pectinifer, sp. nov. (Pl. IV, figs. 1–7.)

Closely allied to *serrulatus*, from which it differs in having the posterior margin of the last thoracic segment ciliated at the sides, the third apical caudal seta not more than half as long as the second, and the first antennæ, when reflexed, covering about three and a half segments. There is also an epaulette of minute cilia on the basal joint of the first antennæ, a mark which Claus seems to have noticed in the European *serrulatus* and intended to represent in figure 1, taf. I of "Das Genus Cyclops," though omitting it in his text. The color is usually a shining yellowish brown.

Length, exclusive of caudal setæ, 1 mm.

This species is common in ponds, ditches, and rain-pools about Cambridge.

Cyclops uniangulatus, nov. sp. (Pl. IV, fig. 17.)

Cephalothorax suboval. First four segments not angulated, nor separated at the sides. Fifth produced into a strong and somewhat recurved angle at either side. Anterior portion of first abdominal segment much swollen, and almost angulated at the sides; not marked off from the posterior portion by the conspicuous lateral indentation seen in certain other species. Last abdominal segment posteriorly fringed with exceedingly minute spines. Caudal stylets somewhat slender; plain, except for the usual six plumose setæ. Of the four terminal caudal setæ, the first — considerably shorter than the caudal segment — is longer than the fourth; the second, about one and a fourth times as long as the third. Pinnæ of web of two intermediate terminal cau-

dal setæ fine, short, and sparsely set. First antennæ seventeen-jointed, and about as long as the first body-segment. The armature of the basal and middle joints of the swimming-feet is the same as in the *C. Thomasi.* That of the apical joints is as follows:

First Foot.

Outer branch	ex., two spines. ap., two setæ. in., three setæ.	Inner branch	ex., one seta. ap., ? ?. in., ? ?.

Second Foot.

Outer branch	ex., three spines. ap., one spine, one seta. in., three setæ.	Inner branch	ex., one seta. ap., one spine, one seta. in., three setæ.

Third Foot.

Outer branch	ex., three spines. ap., one spine, one seta. in., three setæ.	Inner branch....	ex., one seta. ap., two subequal spines (inner shorter). in., three setæ.

Fourth Foot.

Outer branch	ex., three spines. ap., one spine, one seta. in., three setæ.	Inner branch	ex., one seta. ap., two subequal spines. in., two setæ.

Fifth foot bi-articulate. Basal joint wide and bearing a rather long plumose seta at its outer angle. Apical joint small and narrow, bearing a long plumose seta, and interior to the same a small seed-shaped spine shorter than the joint itself. Ovisacs large, ellipsoidal, diverging, reaching posteriorly to a point about even with the end of the furca, and containing many (about (?) ninety) eggs. The color of the animal is dirty-white. Length, exclusive of caudal setæ, 1.55 mm. Cambridge, from a pool near the Museum of Comparative Zoölogy.

Cyclops perarmatus sp. nov. (Pl. I, figs. 9–18.)

First body-segment somewhat narrowed in front, and about as long as the four and a half segments following. Posterior border of penultimate segment of thorax furnished at the sides with a minutely pectinate fringe. Sides of the last thoracic segment finely ciliate, the stout spines of the fifth feet projecting from beneath them. Abdominal and caudal segments greatly foreshortened. Two small lateral protuberances at the anterior end of the scarcely tapering first abdominal segment mark the situation of the vulvæ. Posterior border of last abdominal segment bearing a strong pectinate fringe. Caudal segments about twice as long as broad, and sown on their inner sides with short cilia, certain of which on either segment are placed in a double row running obliquely outward and forward across the dorsal surface. Outer of the two superior caudal setæ quite short and remote from the apex of the segment. Of the four apical setæ, the first and fourth are very short; the second rather longer than the third, and about as long at the cephalothorax. The first and fourth are ciliate-plumose. The second is plain at the base; then sparsely and briefly spino-plumose, the pinnæ becoming gradually feebler toward the tip. The third is on the inner side, ciliate-plumose, excepting the plain basal portion, and on the outer side ciliate-plumose at the base; distad to this briefly spino-plumose as in the second. Eye large, dark red, deeply notched in front. First antennæ eleven-jointed; reaching about to

the posterior third of the first body segment. Second antennæ and mouth parts composed of short and wide joints. Labrum with eight teeth. First and second maxillipeds bearing a transverse row of setæ on the second joint; the second bearing also a cluster of three or four similar setæ on the basal joint. The apical joints of the posterior swimming-feet, as compared with those of the anterior, are much less narrowed than is usual in *Cyclops*. The swimming-feet have, in addition to the *ordinary* armature of setæ and spines, a closely set row of much smaller spines along the outer side of each ramus. Their *ordinary* armature I have not yet ascertained in detail.

The fifth foot is a simple flange-like process of the inflected border of the fifth body segment. It has three obtuse angles, which are truncated for the reception of the three stout, subequal setæ. Of these setæ, the innermost is plumed on all sides with short, stout cilia, the second with slenderer cilia, while the outermost is nearly or quite plain. A line of distinct serrulations extends from one fifth foot to the other.

Color, dirty-white.

Length, exclusive of caudal setæ, 1.15 mm.

Allied to *C. phaleratus*, Koch, from which it differs in the number of joints in the first antennæ, and in some of the details of its armature. The seventh joint of the first antennæ of the present species corresponds with the seventh and eighth of *phaleratus*.

This species is abundant in Glacialis Pond, Cambridge. It is easily recognized by the peculiar habit, which it shares with *phaleratus*, of leaving the drop of water in which it may have been placed, and nervously hitching itself along on the dry glass, where it will remain and perish by drying, if not rescued.

POGGENPOL'S NEW SPECIES OF CYCLOPS.

*Cyclops simplex.** The length of the body, as far as the tail setæ, is 1.5 mm. The antennæ of the first pair are seventeen-jointed, and extend to the third thoracic segment. The body is of an oval form, somewhat pointed posteriorly. The abdominal segments, except the first, are one and a half times as long as broad. These segments are almost square. The furca is somewhat longer than the last abdominal segment. The three terminal segments of the first pair of antennæ are but little longer than the preceding ones; the longest and thickest basal segment is provided with six to eight heavy bristles; it has no hair nor serrulations. The fourth and seventh segments are almost twice as long as the rest, and are furnished with several bristles, while all the segments, beginning with the eighth, have each only one bristle. The fifteenth and sixteenth segments are each provided with

*The identification of *Cyclops Leenwenhockii* of Hoek with *C. simplex* of Poggenpol does not seem to me to be warranted by the study of both text and plates of the two authors. The first antennæ of *Leenwenhockii* reach to the base of the abdomen, while those of *simplex* cover only the first two segments of the body. The basal joint of the fifth foot, also, is short and broad in the former, and long and narrow in the latter. It is probable, too, that Poggenpol would have seen and mentioned a longitudinal ridge on the first antennæ of *simplex*, had one existed as in *Leenwenhockii*, since he describes the joints of these antennæ and their furniture at considerable length.

two bristles; but the last has from five to six long bristles and one spine. The second pair of antennæ consist of four segments of equal length. The first two segments are provided on the interior surface with little hairs. The mandible consists of one plastinated segment, and is similar to the mandible described under *C. Clausii.* Near the little terminal tooth itself there is a rather long segmented bristle; but on the basal part of the mandible there are two long and one short bristle. The maxilla is the same as in *C. Clausii,* but is entirely without the stout spine which is beset with a few setæ, which is distinguished at the base of the two large terminal spines on the mandible of *C. Clausii.* The fifth pair of feet consist of two segments. The basal segment has one long bristle; the second has two, of which one is situated on the summit of the segment, and the other on a small side-elevation. These bristles are plain, not plumose. In the first abdominal segment there is a cemental gland, which consists of three parts; the posterior, not divided, and two front ones. The branches of the furca are each provided with six plumose bristles. The longest of these is three times as large as the furca. The last abdominal segment is posteriorly furnished with a row of thin serrulations. The color is dirty yellow, and the pigment of the eye is dark red.

Cyclops Clausii. The length of the body in female is 1.9 mm.; with tail-bristles, 2.4 mm. The body is longer and narrower than that of *Cyclops simplex.* The first antennæ are very long, and reach as far as the middle of the fourth thoracic segment, and consist of seventeen joints. The last three segments are very long. The basal segment has several bristles and sharp teeth, in form and disposition on the segment entirely corresponding with the same little teeth of *C. tenuicornis,* Claus. The fourth and seventh segments are longest; the twelfth segment, besides the usual bristle, has also a very transparent blade-like appendage. The fifteenth and sixteenth segments are each provided with two bristles. The longitudinal ridge of the seventeenth segment is compressed, and is also, as in *C. coronatus,* Claus, serrated. All the segments, except the last three, are also provided with little teeth, which are disposed longitudinally and transversely; the transverse rows are disposed in the same manner as in *C. coronatus,* Cl., namely, on the front edges of the segments, commencing with the fifth, and consist of quite large teeth; the longitudinal rows consist of very small teeth, which are distributed sometimes in separate groups. The second antennæ consist of four lengthened segments furnished in places with rows of setæ. The basal segment is also provided with a very long and plumose bristle, exactly like the one in *Cyclops tenuicornis.* On the second segment there is to be seen a transverse, obliquely disposed row of sharp little spines. The remaining segments are the same as in *C. coronatus,* with a row of setæ. The labrum is, as in the case of *C. coronatus,* furnished with thirteen blunt teeth. The mandible is the same as that of *tenuicornis,* but its lateral depression is not so deep, and both bristles, which are situated near this depression, are

shorter. The second pair of maxillipeds are distinguished by a very strong development of the spine, which is situated on the jaw-feeler, and it is also distinguished by the presence of a peculiar spine near the top of the maxilliped. This spine is also provided with three or four thick hairs. The maxillipeds of the first pair have only this peculiarity, that all their bristles and spines are thickly covered with long hairs, and besides, at the base of the larger branch of the fifth foot, there is a long, plumed bristle. The swimming-feet have all plumose setæ. The first two segments are provided with transverse rows of teeth. The fifth pair are of two segments, and are provided with four bristles. The basal segment is furnished with a row of hair and has one long, plumose seta. The terminal segment is furnished also with three plumose setæ, of which the middle is the longest and the other the shortest. The first segment of the abdomen is very long and contains a cemental gland, which is divided crosswise into two halves. The remaining segments are quite short and have no furniture whatever, with the exception of the last, which has on its posterior border a row of long spines. The furca is shorter than that of *C. simplex*, and is not longer than the last segment of the abdomen. In each of its branches there is an oblique row of teeth. The inner edges of the branches are plain, without hair. The tail-bristles are plumose. The largest caudal seta is almost six times as long as the furca. The color of the body is green.

Cyclops latissimus. The length of the female is 1.85 mm. without the caudal setæ. This *Cyclops* is easily distinguished by its unusual width of body, which has the appearance of a disc slightly flattened at the sides. The rostrum is very large and somewhat bent, so that it is visible even when the *Cyclops* lies on its abdominal surface. The first abdominal segment is so long that, in spite of the shortened form of the other abdominal segments, the whole abdomen is almost equal in length to the front broad part of the body. (The length of the abdomen with the furca is .78 mm.) The anterior antennæ are very long, namely, 1.2 mm., and being composed of seventeen segments, reach almost to the first abdominal segment. The last three segments are just as short as those of *C. simplex;* the basal, fourth and seventh are the longest; they have several bristles, but, like the others, are destitute of teeth. On the twelfth segment there is an oar-shaped organ. The distinguishing characteristic of the antennæ of *C. latissimus* is this: The fourth segment has a very long and thick pale bristle, which is similar to the same pale bristles on the antennæ of *C. serrulatus*, Fisch. The terminal segment has six to seven long bristles and one short one. The second pair of antennæ consists of quite long segments, having neither setæ nor spines. Of all the segments of the body, only the fifth thoracic segment has furniture. In the middle of this segment, both on the dorsal and the ventral surface, there is a transverse line of quite small teeth. The lateral edges of the segments are furnished on each side with six strong spines, of which three are directed forward and three backward. The rudimentary feet consist of

a basal segment, which has a short plain bristle, and of a terminal segment which has three plain bristles, of which the middle one is somewhat longer than the lateral ones. The cemental gland is exactly the same as that of *C. Clausii*, and is contained in the massive first segment of the abdomen. The fourth abdominal segment has a row of slender spines on its posterior edge. The branches of the fork are thick, and are provided, in addition to the six usual bristles, with one more small spine, which is situated on the exterior side of the branches. The bristles on the corners of the branches are very short, and are slightly furnished with sparse hairs; the other bristles are quite long; on the two main bristles the plumosity begins at quite a distance from its base. Both of the middle bristles are longer than the whole trunk; one is .93 mm. and the other is .87 mm. long. The eye is situated at the base of the long rostrum. The front and the lateral edges of the pigmental spot are convex, and the other is concave.

Cyclops ornatus. Length of the female, 2.4 mm.; male, 1.8 mm. The front, broadened part of the body is twice as long as the abdomen. The posterior edges of all the segments, except the first and fifth of the thorax, are furnished with blunt teeth. The anterior antennæ are very short, and do not reach to the posterior edge of the anterior thoracic segment. The first segment is the longest. The third, seventh and eighth are almost of the same length as the basal segment. The three terminal segments are short. The terminal segment has five or six large and one small bristle; the eighth, ninth and tenth have each two bristles. The posterior antennæ are very short, and consist of four short segments. The rudimentary foot consists of one segment, which has three very short bristles. The first abdominal segment is concave, short, and has at the sides two quite long plumose bristles. The other abdominal segments are very short, so that the whole abdomen, without the furca, is somewhat longer than the three posterior thoracic segments. The fourth abdominal segment has on its posterior edge two kinds of spines: firstly, long slender ones, situated along the whole lower edge of the segment; secondly, two groups of thick spines of three each. The furca is twice as long as the last abdominal segment; its branches are thickly covered with long hair on its interior edges. The caudal setæ are plumose, equal in length almost to the entire abdomen. (The length of the abdomen is .67 mm., and the length of the middle bristle is .62 mm.) The plumosity of the large caudal setæ begins at quite a distance from their base. The color is yellowish green.

Cyclops longicaudatus. Length of the whole body, 1.39 mm., of which .66 is taken up by the abdomen and the furca. The trunk seems still longer, because all the thoracic segments, beginning with the third, get suddenly narrow and become almost of the same width as the abdominal segments. In consequence of this form of the segments, it seems as if the body proper consisted in all of two segments, (to wit, of the first thoracic and the head segments, which had been fused, and of the second free thoracic segment,) and

the other eight segments (seven only in the female) made up the abdomen. The anterior antennæ are very short, and do not reach to the posterior edge of the cephalothorax; the three terminal segments are shorter than the others, but proportionately broader, and at their center, from right and left, are fastened bristles, one on each side. The first, third, seventh and eighth segments are the longest and each has several bristles, while the other segments have each only one or two bristles. The eleventh has six or seven bristles. The second antennæ consist of four quite long segments, which have only setæ, but no hair or teeth. The segments of the body are destitute of furniture. The third thoracic segment, as has already been said, gets suddenly narrower, so that the preceding segment forms quite a projecting edge. The rudimentary foot consists of one segment and three long, plain bristles. All the bristles are fastened to small stump-like processes, but do not form a continuation of the segment itself, such as we saw in the case of *C. ornatus*. The first abdominal segment is twice as long as those that follow it. The last abdominal segment is furnished on the posterior edge with small teeth. The furca is equal in length to the two last abdominal segments, and has quite short bristles. Two of these at the very end of the segment are so small that they might rather be called spines, which even are not plumose; the other bristles are furnished with sparse and quite stout hair; the largest bristle is but a little longer than the furca itself.

Cyclops lascivus. Length of body without furca, 1.5 mm. The fore part of the body is somewhat drawn out and pointed at the end. The segments of the thorax are without projecting edges. The first antennæ have ten segments. The first antennæ of the female, both in the length and in the form of the segments, resemble those of *C. canthocarpoides*, Fisch.; but the antennæ of the male are different, to wit: The *C. canthocarpoides* has the two terminal segments longer than the rest, which are provided with bristles turned forward, but this species has its last two segments almost twice as long as the others, and their bristles are distributed in a very peculiar manner; the terminal segment has a whole tuft of quite long bristles, in a direction perpendicular to the longitudinal axis of the segment, and the tuft itself is not on the top of the segment, but deviating somewhat from it. On the posterior third of the segment there is a bristle turned forward; on the ninth segment there are three bristles, one of which is turned forward and is situated on the small projection of the segment, but the other two are turned backward. The second antennæ consist of very long segments, while the *C. canthocarpoides* has short ones, which are furnished on the inner surface with groups of teeth. Characteristic of the described species is the presence on the terminal segment of a long bristle which does not exist in *C. canthocarpoides* Fisch. The mouth-parts of *C. lascivus*, as it seems, are not materially different from those of *C. canthocarpoides*. The rudimentary feet consist of three bristles, which form an immediate continuation of the fifth thoracic segment. The posterior edges of the abdominal segments are furnished with hairs, but the furca has

none at all: a fact which again distinguishes this Cyclops from *C. canthocarpoides*, whose furca-branches are furnished with a number of teeth and hairs. The tail-bristles are thickly plumose, and only nearer to their roots are observed spines, with which the bristles of *C. canthocarpoides* are covered along its entire length. The front edge of the pigmental spot is convex, the posterior concave. This species, and particularly its female, resembles at first sight *C. canthocarpoides*, but is undoubtedly distinguished from it by the marks pointed out above.

C. igneus. Length of body .8 mm., very long and narrow. The first antennæ are ten-jointed, and reach to the second thoracic segment. The first, third, sixth and seventh segments are the longest, the fourth has a very long and stout bristle by which this species is easily distinguished from the other *Cyclops* of the same group. The three terminal segments are very short and broad; and each, except the last, which has on the top six or seven bristles, has two bristles. The second antennæ are shorter than those of *C. lascivus;* their terminal segment has no long bristle, but has quite a stout spine. There are no teeth or hair on the segments. The segments of the body and of the trunk are also without any furniture. The rudimentary foot is the same as in *C. longicaudatus; i. e.*, it is a simple elevation of the fifth thoracic segment, on which are situated three simple spines, the middle one of which is shortest. The first abdominal segment is scarcely longer than the following ones. The fourth segment on the posterior edge has a row of spines; the furca is twice and a half as long as the last segment of the abdomen. Of the tail-bristles, but two are long. The others are short. The long bristles are, at the base, furnished with sparse hairs; but their ends are thickly plumose. The front and side edges of the pigmental spot are concave, but the posterior is convex. The lenses are remarkable for being exceedingly convex. The whole body, particularly its front part, is full of orange-red, fat-globules; but the real color of the *Cyclops* is yellow.

C. Fischeri. Length of the male, 1 mm.; female, 1.2 mm. The first antennæ are six-jointed and very short; they reach only to the posterior part of the cephalothorax. Segments one and three are the longest, and are furnished with a large number of short bristles. The sixth segment is somewhat longer than the preceding ones. The male's last segment is very long, and has the shape of a cone; on its very tip there are no bristles at all, but instead a very large bristle, turned not forward but backward, is situated on its lateral edge, on which are found several additional short bristles. The antennæ of both the first and second pair have no hair and no teeth. The thoracic segments have very strongly projecting posterior edges. The fourth segment has on each side a row of small hairs, and the fifth has long teeth on its posterior edge. The rudimentary foot consists of two stout bristles, which are covered with short hair, and which are situated on the small elevation of the fifth thoracic segment. The rudimentary foot of the female consists of three bristles. All the abdominal segments are beset, on the pos-

terior edge, with long teeth; but the first segment, in addition to this, has also on each side one large plumose bristle and two small ones. The position and shape of these bristles strongly remind one of those bristles of the fifth thoracic segment which compose the rudimentary foot. The fourth abdominal segment is furnished on the posterior edge with stout, long spines; but on the dorsal surface it has a delta-shaped figure which consists of small teeth. The branches of the furca are adorned with seven parallel rows of teeth The middle tail-bristles consist, as it were, of three parts—first, the basal, naked; second, the middle, furnished with sparse teeth; and third, the terminal, thickly covered with hair. The largest bristle is equal in length to the whole abdomen; the other two bristles are very short. On the external edge of the branches of the furca are three spines each. The color is reddish-yellow.

EXPLANATION OF PLATES.

[NOTE.—Separate dissections of the same species were often necessarily drawn under different powers. In fig. 4, plate III, both sides of the third caudal seta should have been represented as webbed. In fig. 2, plate IV, the ridge on the apical joint of the first antenna should have been represented by a double line, as in the two joints preceding.]

PLATE I.

Fig. 1. *Cyclops elongatus*, Cls. Adult female seen from above.
" 2. *C. pulchellus*, Koch. Swimming-foot of the fourth pair.
" 3. *C. pulchellus*, Koch. Apical joint of outer branch of a foot of the second pair.
" 4. *C. pulchellus*, Koch. Apical joint of inner branch of a foot of the second pair.
" 5. *C. pulchellus*, Koch. Apical joint of outer branch of a foot of the third pair.
" 6. *C. pulchellus*, Koch. Apical joint of inner branch of a foot of the third pair.
" 7. *C. pulchellus*, Koch. Apical joint of outer branch of a foot of the first pair.
" 8. *C. pulchellus*, Koch. Apical joint of inner branch of a foot of the first pair.
" 9. *C. perarmatus*, sp. n. Adult female from above.
" 10. *C. perarmatus*, sp. n. First antenna. (This and the following dissections of *perarmatus* are from the female.)
" 11. *C. perarmatus*, sp. n. Fifth foot.
" 12. *C. perarmatus*, sp. n. Second antenna.
" 13. *C. perarmatus*, sp. n. First abdominal segment, broadened a trifle by mechanical pressure, and slightly turned to one side.
" 14. *C. perarmatus*, sp. n. Labrum.
" 15. *C. perarmatus*, sp. n. Second maxilliped.
" 16. *C. perarmatus*, sp. n. First maxilliped.
" 17. *C. perarmatus*, sp. n. Maxilla.
" 18. *C. perarmatus*, sp. n. Mandible and palp.
" 19. *C. elongatus*, Cls. Second maxilliped.
" 20. *C. elongatus*, Cls. Second antenna.
" 21. *C. elongatus*, Cls. First antenna of female.
" 22. *C. elongatus*, Cls. First maxilliped.
" 23. *C. elongatus*, Cls. Caudal rami and its furniture.

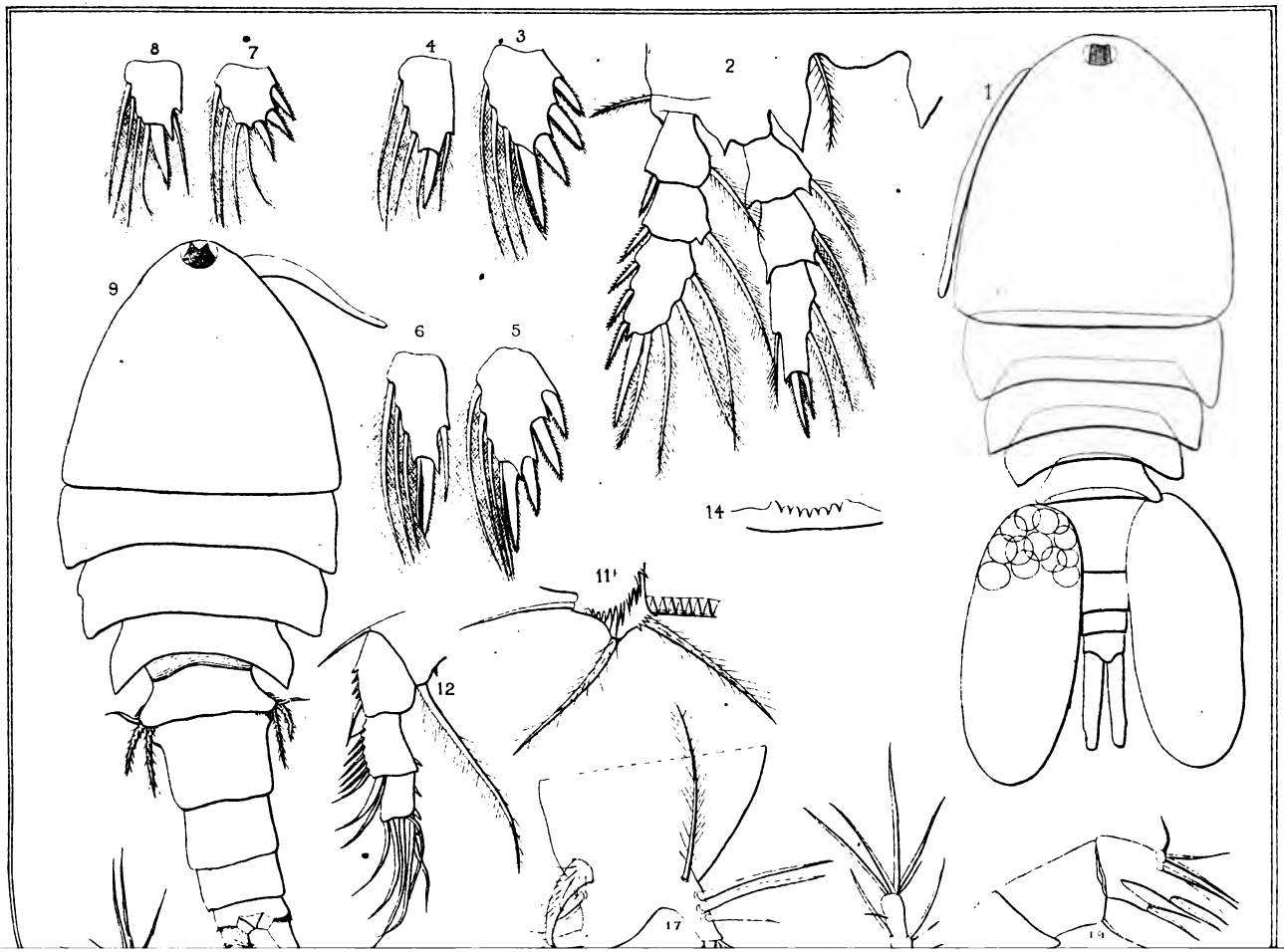
PLATE II.

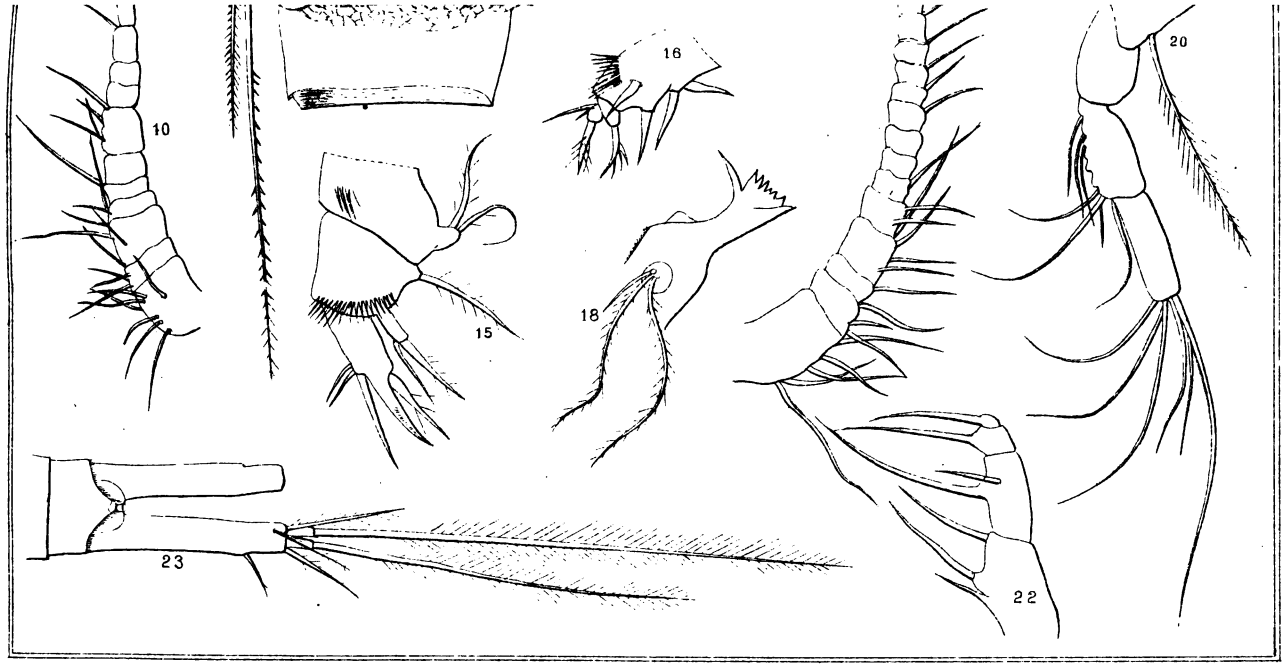
Fig. 1. *Cyclops tenuicornis*, Cls. Adult female from above.
" 2. *C. tenuicornis*, Cls. Second antenna.
" 3. *C. tenuicornis*, Cls. Caudal rami and furniture, with last abdominal segment.
" 4. *C. tenuicornis*, Cls. Swimming-foot of the (? fourth) pair.
" 5. *C. tenuicornis*, Cls. First antenna.
" 6. *C. tenuicornis*, Cls. Maxilla.
" 7. *C. tenuicornis*, Cls. Second maxilliped.
" 8. *C. tenuicornis*, Cls. Portion of labrum with eleven teeth.
" 9. *C. tenuicornis*, Cls. First maxilliped.
" 10. *C. tenuicornis*, Cls. Complete labrum with nine teeth.
" 11. *C. tenuicornis*, Cls. Mandible and palp.
" 12. *C. tenuicornis*, Cls. Fifth foot.
" 13. *C. tenuicornis*, Cls. Last thoracic segment.
" 14. *C. tenuicornis*, Cls. Diagrammatic outline of cemental gland.
" 15. *C. signatus*, Cls. Second maxilliped.

PLATE III.

Fig. 1. *Cyclops Thomasi*, Forbes. First abdominal segment of male from side.
" 2. *C. Thomasi*, Forbes. First antennæ of male from side.
" 3. *C. Thomasi*, Forbes. Adult male from above.
" 4. *C. Thomasi*, Forbes. Adult female from above, drawn to the same scale as fig. 3, to show relative size of the sexes.
" 5. *C. Thomasi*, Forbes. Fifth foot of a male.
" 6. *C. Thomasi*, Forbes. Just hatched nauplius.
" 7. *C. Thomasi*, Forbes. Fifth foot of a female.
" 8. *C. Thomasi*, Forbes. First antenna of female.
" 9. *C. Thomasi*, Forbes. First abdominal segment of female, showing the cemental gland from above, and the anterior constriction dividing the segment into two portions, (homologues of the first and second abdominal segments of the male?)
" 10. *C. Thomasi*, Forbes. Labrum.
" 11. *C. Thomasi*, Forbes. Caudal ramus from outer side.
" 12. *C. Thomasi*, Forbes. First abdominal segment of female from the side (and partly from below), showing the cemental gland and the male capsules (spermatophores) attached to the vulvæ.
" 13. *C. Thomasi*, Forbes. First maxilliped.
" 14. *C. magnoctavus*, sp. n. Adult female from above.
" 15. *C. magnoctavus*, sp. n. First antenna of female.
" 16. *C. magnoctavus*, sp. n. A portion of the abdomen, with caudal rami and furniture.
" 17. *C. magnoctavus*, sp. n. Fifth foot.
" 18. *C. magnoctavus*, sp. n. Labrum.
" 19. *C. magnoctavus*, sp. n. Ovisac with minimum number of eggs.
" 20. *C. magnoctavus*, sp. n. Second antenna.
" 21. *C. magnoctavus*, sp. n. Apical joint of inner branch of a foot of the first pair.
" 22. *C. magnoctavus*, sp. n. Apical joint of outer branch of a foot of the first pair.
" 23. *C. magnoctavus*, sp. n. Second maxilliped.

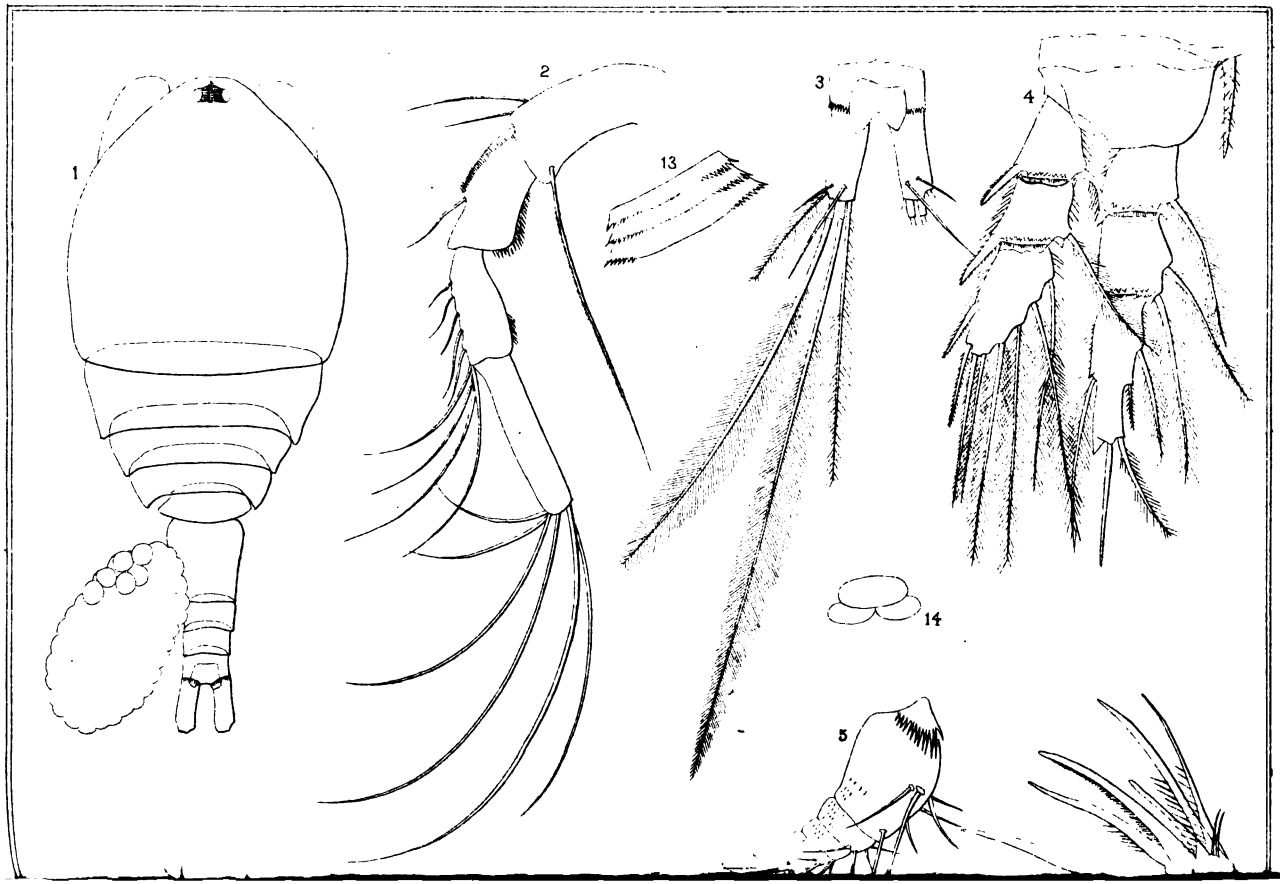
PLATE I.





F. W. CRAGIN. DEL.

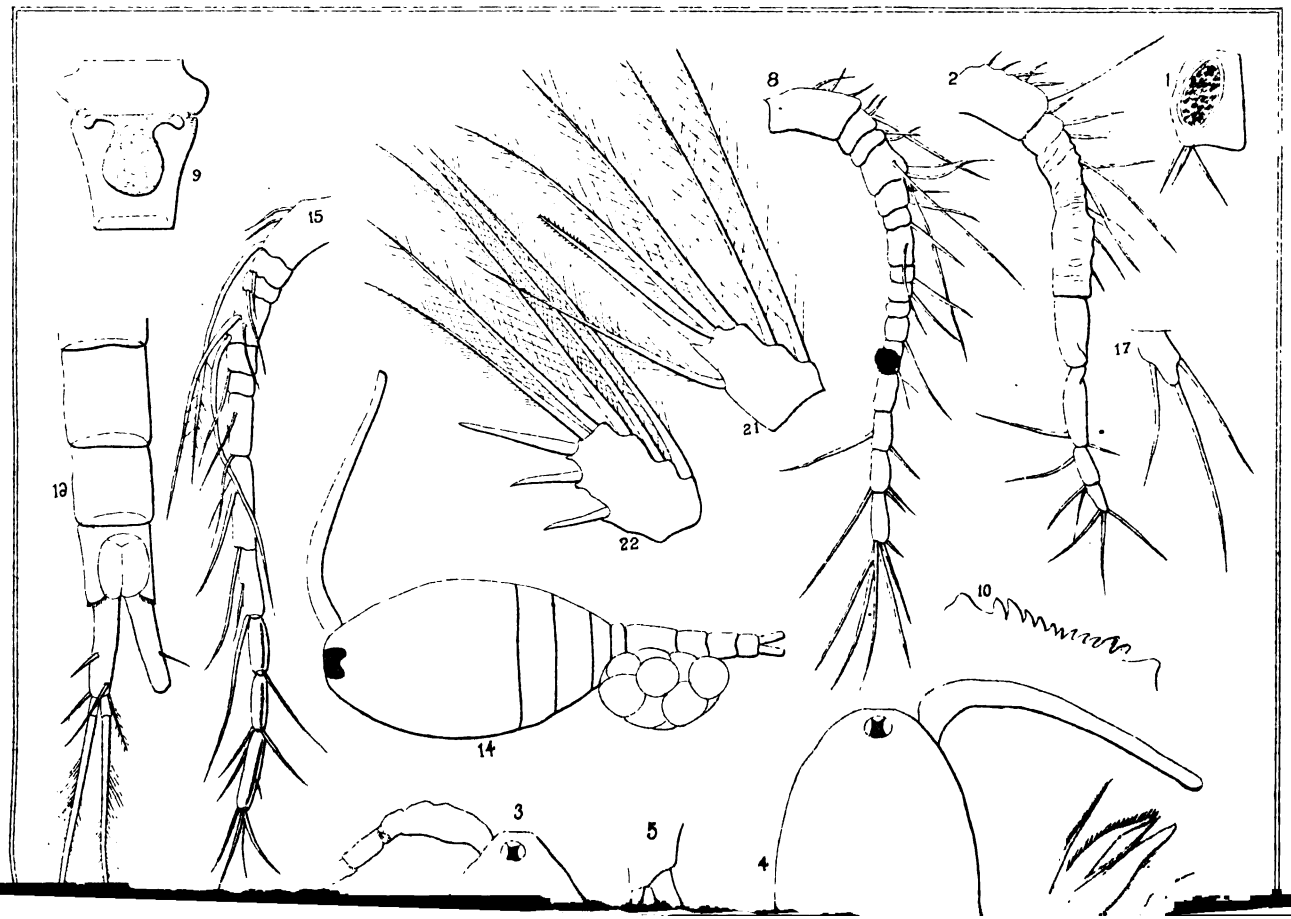
PLATE II

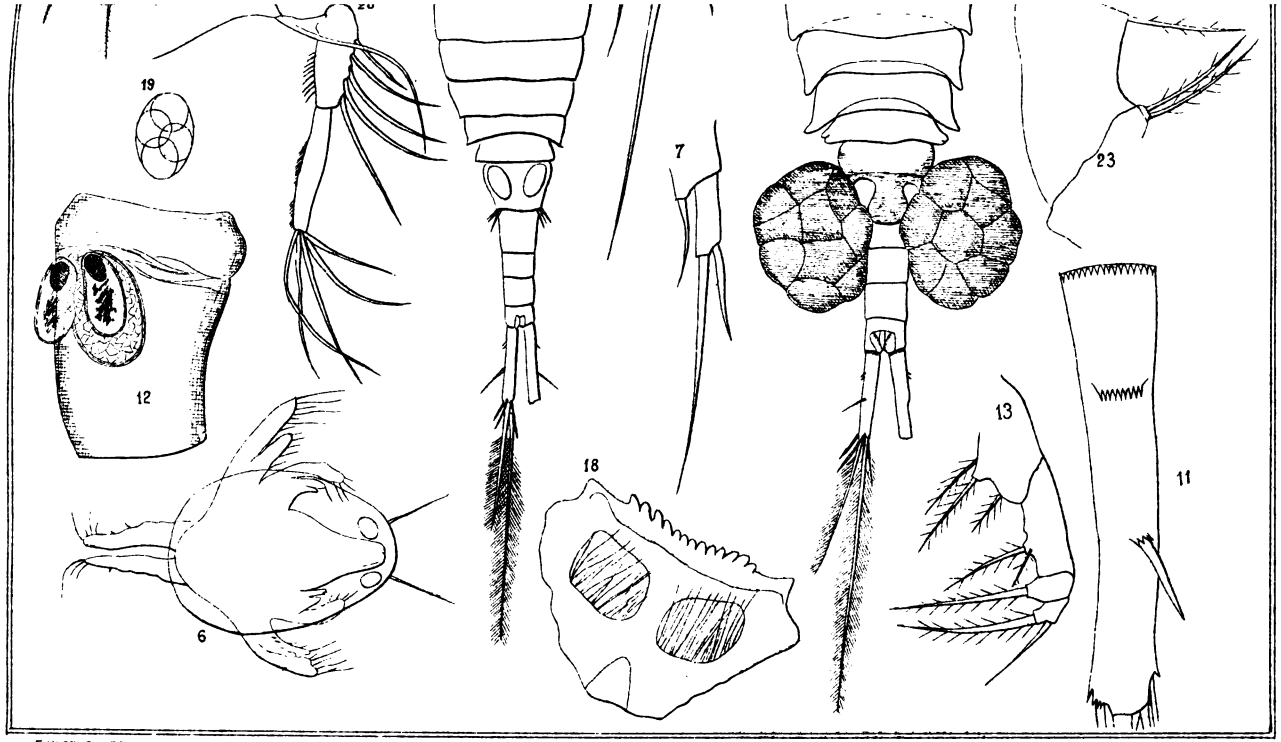


F.W.CRAGIN, DEL.

TROUT & LUCKETT, LITHO

PLATE. III.

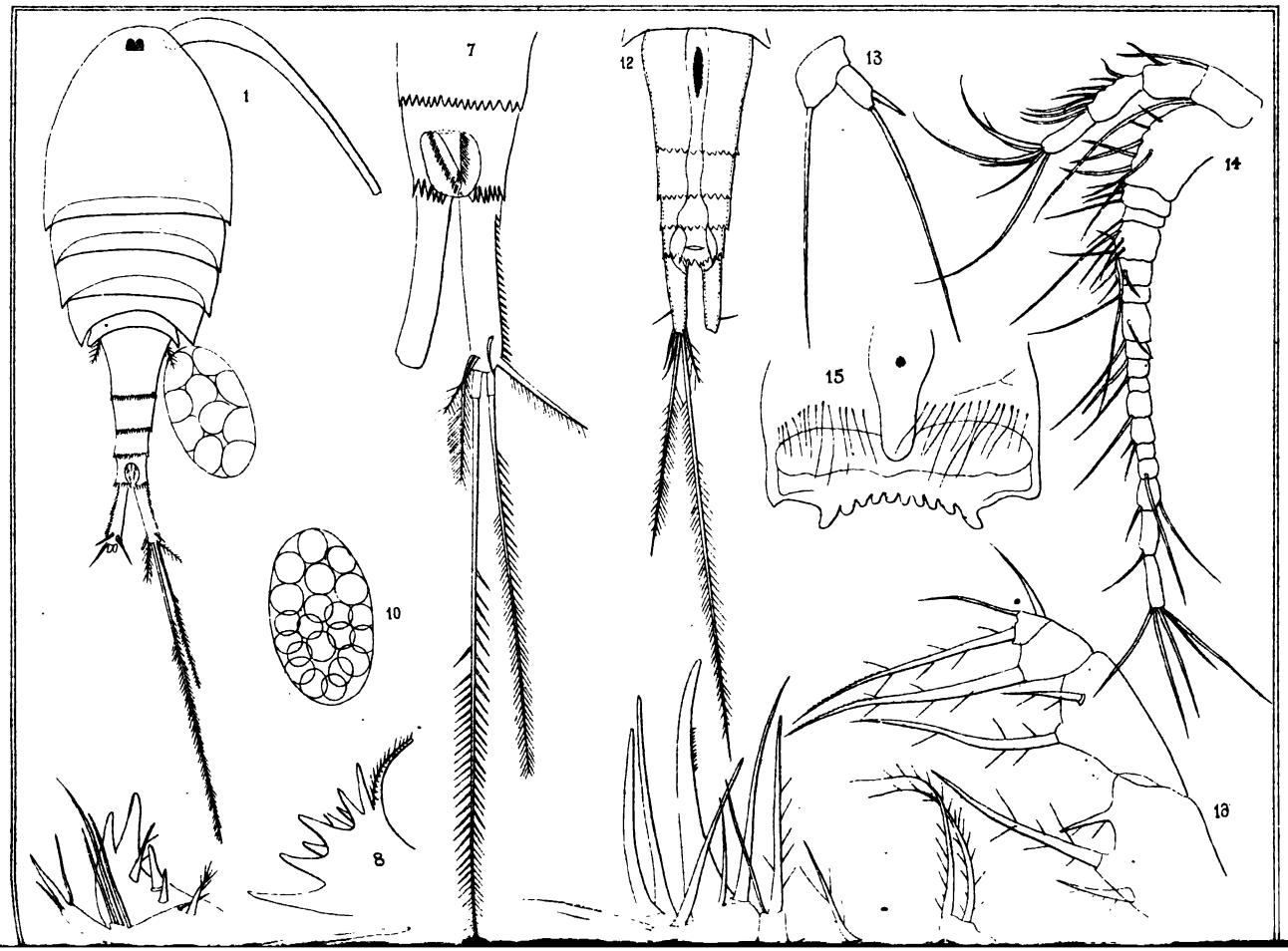




F. W. CRAGIN, DEL.

TROUT & BLOCKETT LITHGS.

PLATE IV.



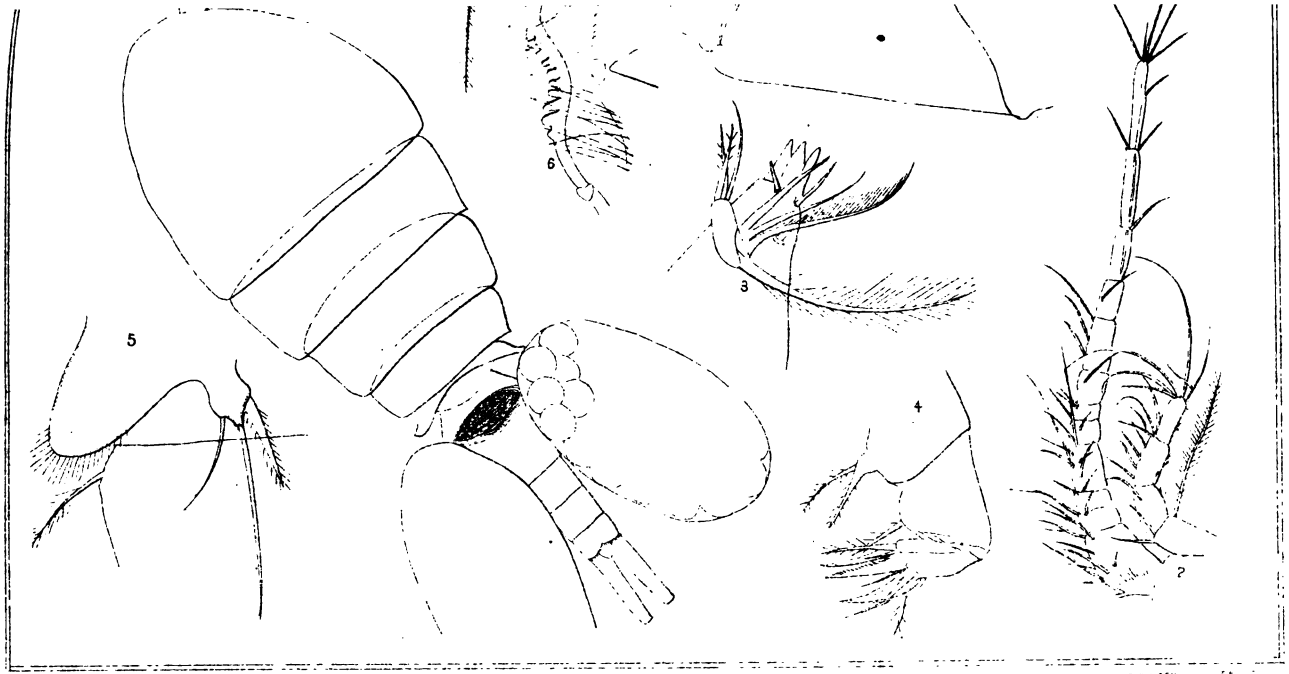

1
2
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PLATE IV.

Fig. 1. *Cyclops pectinifer*, sp. n. Adult female from above.
" 2. *C. pectinifer*, sp. n. First and second antennæ of female.
" 3. *C. pectinifer*, sp. n. Maxilla.
" 4. *C. pectinifer*, sp. n. Second maxilliped.
" 5. *C. pectinifer*, sp. n. Fifth foot and adjacent border of the body.
" 6. *C. pectinifer*, sp. n. Labrum.
" 7. *C. pectinifer*, sp. n. End of abdomen with caudal rami and furniture.
" 8. *C. viridis*, Fischer. Mandible.
" 9. *C. viridis*, Fischer. Maxilla.
" 10. *C. viridis*, Fischer. Ovisac filled with eggs.
" 11. *C. viridis*, Fischer. Second maxilliped.
" 12. *C. viridis*, Fischer. Abdomen and tail.
" 13. *C. viridis*, Fischer. Fifth foot.
" 14. *C. viridis*, Fischer. First and second antennæ.
" 15. *C. viridis*, Fischer. Labrum.
" 16. *C. viridis*, Fischer. First maxilliped.
" 17. *C. uniangulata*, sp. n. Adult female from above.

METEOROLOGICAL SUMMARY FOR THE YEAR 1882.

PREPARED BY PROF. F. H. SNOW, OF THE UNIVERSITY OF KANSAS, AT LAWRENCE.

The weather of 1882 abounded in superlatives. It had the highest mean temperature, the highest maximum barometer, the smallest and best distributed rainfall, the coolest summer, the warmest autumn, and, with one exception (1877), the warmest winter months upon our 15 years' record. Notwithstanding the extremely small rainfall, crops of all kind were abundant, in most cases surpassing all previous yields. This furnishes further confirmation of the statement of our reports of 1871 and 1875, that a comparatively small amount of rain, well distributed, is more desirable than a larger amount unfavorably distributed.

TEMPERATURE.

Mean temperature of the year, 54.94°, which is 1.51° above the mean of the 14 preceding years. The highest temperature was 105°, on September 12th; the lowest was 6.5° below zero, on the 7th of December, giving a range for the year of 111.5°. Mean at 7 A. M., 49.21°; at 2 P. M., 63.95°; at 9 P. M., 53.30°.

Mean temperature of the winter months, 35.19°, which is 5.18° above the average winter temperature, of the spring, 54.67°, which is .72° above the average; of the summer, 72.92°, which is 3.69° below the average; of the autumn, 56.97°, which is 3.81° above the average.

The coldest month of the year was December, with mean temperature

31.25°; the coldest week was January 16th to 22d, mean temperature 25.01°; the coldest day was December 7th, mean temperature 3.2°. The mercury fell below zero only once, on December 7th, not having previously touched zero since February 19th, 1881.

The warmest month was June, with mean temperature 74.14°; the warmest week was June 27th to July 3d, mean 82.83°; the warmest day was June 28th, mean 84.2°; the warmest hour was 2:30 to 3:30 P. M., September 12th, mean 105°. The mercury exceeded 100° on two days—September 12th and 13th—and reached or exceeded 90° on 40 days, viz.: 1 in May, 12 in June, 9 in July, 11 in August, and 7 in September.

The last hoar frost of spring was on May 22d; the first hoar frost of autumn was on October 19th, giving an interval of 150 days, or nearly five months, entirely without frost.

The last severe frost of spring was on March 24th; the first severe frost of autumn was on the 11th of November; giving an interval of 232 days, or nearly eight months, without severe frost. This is the longest period of immunity from severe frost in the past 15 years. No frost during the year caused damage to fruit buds or trees. The hoar frost of May 22d injured strawberries in some localities.

RAIN.

The entire rainfall, including melted snow, was 27.60 inches, which is the smallest annual rainfall on our 15 years' record, and is 7.12 inches below the average. Either rain or snow, or both, fell on 102 days—one less than the average. On 14 of these days the quantity was too small for measurement.

The longest drouth in the 15 years of observation, was from July 30th to September 18th, during which period of 7 weeks less than a tenth of an inch of rain was registered. This drouth was not disastrous, because the staple crops were already well matured before the drouth began.

The number of thunder showers was 26. Hail fell on 7 days.

SNOW.

The entire depth of snow was 18 inches, which is 3.31 inches below the average. Of this amount, 2 inches fell in January, 2 in February, 9 in March, and 5 in December.

Snow fell on 14 days. The last snow of spring was on March 9th; the first snow of autumn was on November 16th.

FACE OF THE SKY.

The average cloudiness of the year was 45.41 per cent., which is 1.08 per cent. above the average. The number of clear days (less than one-third cloudy) was 162; half-clear (from one to two-thirds cloudy), 103; cloudy (more than two-thirds), 100. There were 80 days on which the cloudiness reached or exceeded 80 per cent. There were 53 entirely clear and 47 entirely cloudy days. The clearest month was August, with a mean of 32.37

per cent.; the cloudiest month was December, mean 61.61 per cent. The percentage of cloudiness at 7 A. M. was 50.41; at 2 P. M., 49.82; at 9 P. M., 35.99.

DIRECTION OF THE WIND.

During the year, three observations daily, the wind was from the S. W. 272 times, N. W. 269 times, S. E. 155 times, S. 128 times, N. E. 102 times, N. 72 times, E. 71 times, W. 26 times. The south winds (including southwest, south and southeast) outnumbered the north (including northwest, north and northeast) in the ratio of 555 to 443.

VELOCITY OF THE WIND.

The number of miles traveled by the wind during the year was 137,736, which is 687 miles below the annual average for the 9 preceding years. This gives a mean daily velocity of 377 miles, and a mean hourly velocity of 15.71 miles. The highest hourly velocity was 60 miles, on March 21st; the highest daily velocity was 919 miles, on January 16th; the highest monthly velocity was 16,608 miles, in March. The three windiest months were March, April and May; the three calmest months were July, August, and September. The average velocity at 7 A. M. was 14.51 miles; at 2 P. M., 17.73 miles; at 9 P. M., 15.49 miles.

BAROMETER.

Mean height of barometer column, 29.113 inches, which is with one exception (1874, 29.121 inches) the highest annual mean on our record. Mean at 7 A. M., 29.141 inches; at 2 P. M., 29.085 inches; at 9 P. M., 29.114 inches; maximum, 29.985 inches, on December 17th, which is more than two-tenths of an inch higher than any previous maximum; minimum, 28.349 inches, on March 26th; yearly range, 1.636 inches. The highest monthly mean was 29.200 inches, in January; the lowest was 28.992 inches, in June. The barometer observations are corrected for temperature and instrumental error.

RELATIVE HUMIDITY.

The average atmospheric humidity for the year was 68.63; at 7 A. M., 79.65; at 2 P. M., 50.95; at 9 P. M., 75.31. The dampest month was December, with mean humidity 76.70; the driest month was September, mean humidity, 59.20. There were fourteen fogs during the year. The lowest humidity for any single observation was 7 per cent., on September 12th. This extreme dryness of the air existed during the continuance of the withering "simoon" of that date.

The following tables give the mean temperature, the extremes of temperature, the velocity of the wind, the percentage of cloudiness, the relative humidity, the rainfall (including melted snow), and the depth of snow, for each month of the year 1882, and a comparison with each of the fourteen preceding years:

1882.	Mean temperature.	Max. temperature.	Min. temperature.	Miles of wind.	Relative humidity.	Rain, inches.	Snow, inches.	Mean cloudiness.
January	32.68°	65.0°	5.0°	11,678	66.25	0.70	2.0	51.72
February	41.65	73.0	12.0	11,907	69.70	1.66	2.0	45.59
March	46.90	79.0	17.0	16,608	64.93	1.62	9.0	40.22
April	56.83	88.0	35.0	14,226	61.77	3.20	0.0	51.77
May	60.27	90.0	36.5	13,695	66.40	3.53	0.0	63.44
June	74.14	99.0	44.5	10,874	69.90	4.72	0.0	38.99
July	72.05	99.0	52.0	7,464	75.00	4.03	0.0	38.92
August	72.55	95.0	52.5	7,463	72.40	0.09	0.0	32.37
September	69.30	105.0	46.0	10,026	59.20	1.65	0.0	35.67
October	58.54	84.5	34.0	11,435	69.20	3.08	0.0	41.51
November	43.07	80.0	20.0	11,118	72.00	2.08	0.0	43.11
December	31.25	58.0	*—6.5	11,247	76.70	1.24	5.0	61.61
Means	54.94	84.6	29.0	11,478	68.63	2.30	1.5	45.41

COMPARISON WITH PRECEDING YEARS.

Year.	Mean temperature.	Max. temperature.	Min. temperature.	Miles of wind.	Mean cloudiness.	Relative humidity.	Rain, inches.	Snow, inches.	Rainy days.
1868	53.36°	101.6°	*—16.5°	.....	42.35	.....	37.58	27.50	77
1869	50.99	96.0	— 5.0	.....	49.23	78.2	38.51	18.00	105
1870	54.50	102.0	—10.0	.....	47.88	68.4	31.32	9.50	100
1871	54.30	103.0	— 6.0	.....	47.37	65.9	33.23	29.75	120
1872	51.90	97.0	—18.0	.....	44.33	64.4	32.63	23.25	116
1873	52.71	104.0	—26.0	154,508	42.46	64.0	32.94	26.50	101
1874	54.20	108.0	— 3.0	145,865	45.54	65.7	28.87	43.00	99
1875	50.60	99.0	—16.5	145,816	44.81	66.7	28.87	5.00	106
1876	52.76	98.0	— 5.0	148,120	41.27	66.8	44.18	24.75	102
1877	54.16	99.0	— 9.0	113,967	47.12	72.6	41.09	15.50	126
1878	55.33	98.0	— 6.0	125,793	40.65	70.2	38.39	25.50	107
1879	54.67	99.5	—16.0	124,768	40.01	67.1	32.68	10.35	90
1880	54.01	101.0	—12.0	146,039	40.15	67.9	32.65	7.00	89
1881	54.65	104.0	— 8.0	141,430	47.52	70.1	33.27	32.50	110
1882	54.94	105.0	— 6.5	137,736	45.41	68.6	27.60	18.00	102
Mean of 15 years	53.53	101.0	—12.2	138,377	44.40	68.3	34.25	21.07	103

*The minus sign denotes temperature below zero.

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